Essays on Strategy, Institutions, and Multinationals in Global Supply Chains

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Abstract

This dissertation investigates two major themes: (1) the strategies that global firms use to overcome weak institutions in their outsourcing and (2) how local institutions affected how firms reconfigured their global supply chains in response to the financial crisis. All three papers use a unique dataset of international contract manufacturing orders that provides hitherto unavailable insight into the global supply chains of many of the world's largest brands in footwear, sportswear, and apparel.

In the first essay I create a formal model that examines the use of relational contracting by firms to overcome weak contracting institutions in their supply chains. The model predicts that, when the risk of future demand shocks is high, buyers make long-term commitments to source from suppliers in weak institution countries. I test this model and find that buyers preserved their relationships with suppliers in weak contract enforcement countries during the financial crisis for reasons that cannot be explained by cost. In conjunction with the model, these results suggest that relying on relational contracting to overcome weak contracting institutions can reduce a buyer's flexibility in configuring his supplier networks.

In the second essay, I examine whether firms choose to source from multinational (MNC) suppliers instead of local suppliers as a means of overcoming weak contract enforcement institutions or as a means of accessing supply chain management capabilities. I find strong evidence that buyers are more likely to source from MNC suppliers in countries where contract enforcement is weak and when they have less

experience sourcing from a given country. Buyers are also more likely to source from MNC suppliers when they source a wider variety of products, have smaller supplier networks, and have smaller order volumes.

My third essay investigates how trade credit terms are affected by local credit markets, financial institutions, and market power. I find that trade credit terms are longer when local credit markets are more developed and when buyers have market power. I also test how trade credit terms responded to the financial crisis and find that terms lengthened subject to the depth of local credit markets and buyer market power.

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The Hidden Costs of Using Relational Contracting to Overcome Weak Contracting Institutions: Evidence from Global Supplier Networks during the Financial Crisis

1.1 Introduction

The relational contracting literature has long noted that private contract enforcement mechanisms – such as developing trust, or relying on the value of the relationship in the future to ensure agreement – can be used as a substitute for formal contracting, and can allow for greater flexibility in responding to events that cannot be foreseen ex-ante (Macaulay 1963, Macneil 1978, Klein & Leffler 1981). The international business literature has further validated that firms do rely more on private enforcement when formal contract enforcement institutions are weak (Johnson, McMillan and Woodruff 2002, Antras and Foley 2011). However, this chapter argues that when firms source from suppliers in multiple different contracting environments, and rely on relational contracting – a type of private enforcement – to overcome the negative effects of weak contracting institutions, they decrease their ability to optimally reconfigure their supplier networks in response to fluctuations in demand. Using a formal model of multi-country sourcing, I find that, when fluctuations in demand are high, buyers make long term commitments to use suppliers in weak institution countries, and use suppliers in strong countries only when demand is high. In doing so buyers may end up terminating relationships with suppliers that charge lower prices and be unable to take advantage of new, lower priced, sourcing opportunities. The model is the first formal model of relational contracting in the context of multi-country sourcing, and one of few models of relational contracting that incorporate shocks. I test the results of this model using a confidential dataset of contract manufacturing orders that is unique in terms of the

number of large global buyers and the breadth of countries represented, over many years. I use the recent financial crisis as a quasi-natural experiment to identify the tradeoffs buyers made by using relational contracting to overcome weak institutions. I find strong support that buyers were much more likely to stop ordering from suppliers in strong contract enforcement countries while continuing to order from suppliers in weak enforcement countries even when controlling for price and cost. Further, buyers mere much less willing to stop ordering from suppliers with whom they had long relationships.

I interpret these results to signify that, by relying on relational contracting in countries with weak institutions, these buyers lessened their ability to reconfigure their supply chains and take advantage of the reduced demand to lower their costs. Further, in contrast to the literature that suggests that local firms benefit from stronger institutions, these results suggest that suppliers in weak contract enforcement countries were protected by their country's weak contracting institutions at the expense of suppliers in countries with stronger institutions.

This chapter is divided into seven sections. In Section 1.2 I review the theoretical literature on private enforcement and formal contracting as well as the empirical literature on the use of private enforcement in different enforcement environments. I then create a model starting with a simple incomplete contracting model, extending it to an infinite horizon setting, introducing shocks to demand, adding multi-country sourcing, and, finally, introducing differences in cost between suppliers. I use this model to generate hypotheses about which suppliers would continue to receive orders, and which would not, after a shock to demand like the financial crisis.

In Section 1.3 I describe the empirical setting and the data, namely a unique dataset of the purchase orders of 28 large US buyers with their 668 suppliers in 56 countries primarily in the footwear, apparel, and sportswear industries, worth $10.9bn, from 2007-2009. I present the results of the analysis in Section 1.4. In Section 1.5 I conduct an extensive array of robustness checks. Finally, in Section 1.6, I discuss the results, their contributions and limitations, and directions for future research.

1.2 Theoretical Development

In this section I look at the prior literature on using private enforcement mechanisms in response to weak institutional environments. I draw on the literatures on the property rights view of the firm, transaction costs, relational contracting, and international business, and show that there are substantial tradeoffs to using private enforcement to mitigate the effect of weak institutional environments, that have gone unnoticed. I then create a model of multi-country sourcing starting with a simple incomplete contracting model, which I extend to an infinite horizon setting, adding shocks to demand, sourcing from two countries with different levels of contract enforcement, and differences in supplier costs.

1.2.1 Literature Review

A cornerstone of this investigation is the notion that contracts are either incomplete, i.e. it is not possible to write a binding contract that specifies all future contingencies, or are prohibitively costly to enforce, which in turn leads firms to use "private" mechanisms to enforce agreements. The most studied of these mechanisms is vertical integration going back to Coase (1937) and forming the basis for both transaction cost economics (Williamson 1979) and the property rights view of the firm literature

(Grossman and Hart 1986). In both of these streams of the literature, a buyer chooses to vertically integrate with its supplier in order to remove or mitigate the likelihood that the supplier will act opportunistically against the interests of the buyer or in order to elicit superior investment by the crucial party. Later work has extended this literature to look at how firms behave in different institutional contexts. Henisz and Williamson (1999) and Henisz (2000) found that foreign firms operating in an environment with a high risk of government expropriation were less likely to vertically integrate except in the presence of contractual hazards in which case they were more likely to vertically integrate. Expanding on the property rights view, Antras and Helpman (2004) explicitly equate incomplete contracting with complete contracting but with weak enforcement by contract enforcement institutions. In their model, firms vertically integrate in weak contract enforcement environments and outsource to third parties in strong environments. Yeaple (2006) tests this model and finds broad support for it. Feenstra and Hanson (2005) look at the ownership of export processing plants in China and find that factories tend to be owned by the foreign party when either large relationship specific investments must be made or when contracting costs are higher due to weak local enforcement.

A limitation of this literature is that it does not account for the fact that an ever increasing number of firm activities, and in increasing volumes, are being outsourced to third parties abroad. Further, this outsourcing is growing particularly quickly in countries with weak contract enforcement institutions like China, Vietnam, and Indonesia. A likely explanation for this is that firms are relying on private enforcement mechanisms other that vertical integration to deter opportunistic behavior by their suppliers.

Many alternative private enforcement mechanisms are suggested by the relational contracting literature, going back to Macaulay (1963). This literature suggests that firms can enforce agreements while remaining non-integrated, and thus both avoid the potential negative incentive effects that can result from vertical integration and gain greater flexibility than with formal contracting, because firms can respond more efficiently to states of nature that would have been unforeseen in the past when a formal contract would have been signed. The mechanisms suggested by this literature roughly divide into two categories – those that look at the history of the parties working together, and those that look at the expected benefit of the parties working together in the future. Much of the work in the former category looks at the "trust" that develops between parties that makes it less likely that either party will act opportunistically (Granovetter 1985, Gulati 1995, Zaheer et al 1998, Poppo and Zenger 2002). The work in the latter category notes that the loss of a (discounted) future premium rent stream that results from parties working together, the "shadow of the future", prevents the parties from acting opportunistically (Klein and Leffler 1981, Axelrod 1984, Baker et al. 2002). Recent work by Poppo et al. (2008) has tried to unify these categories and has found that prior relationship history lessens the likelihood that a party will act opportunistically mainly by increasing the parties' expectations that they will work with each other in the future.

A few papers have tried to measure the strength of relational contracting in different institutional contexts and they have largely focused on using trade credit as a measurement of relationship strength. Johnson et al. (2002) look at four transition countries and find that firms rely more on relational mechanisms when courts are weak and that firms are more willing to extend credit to suppliers when they have longer

relationships. Antras and Foley (2011) extend this work further, developing a model that predicts that trade credit will be extended more when contracting institutions are strong and parties have had longer relationships with each other, and testing it using the international sales data of a major poultry producer.

While a broad literature has found that institutions have large impacts on firms that rely on them (La Porta et al. 1997, Khanna and Palepu 2000, Johnson et al. 2002), much of the literature on relational contracting implies that it can be used either to mitigate the negative effects of weak institutions or be used as a complement to strong institutions. Unlike this literature, which has emphasized the advantages of using relational contracting to overcome weak institutions, the disadvantages from using relational contracting have been largely overlooked.

Since using relational contracting involves the threat of the loss of future business, and, according to Poppo et al (2008), building expectations about the value of that future business over time, buyers can be restricted in their actions when those actions diminish the value of that future business, when relational contracting is important. For example, a buyer that only occasionally sources from a supplier will be less efficient at deterring opportunistic behavior (or need to pay a higher price to ensure compliance) than a buyer that sources the same amount regularly because the value of the first buyer's future business is less. Similarly, if a buyer stops sourcing from a supplier during a temporary drop in demand, it informs that supplier's expectations of business from that buyer during future crises. The supplier can expect that it will not receive business during future crises and will thus value that buyer's future business less than if the buyer had continued to source from him throughout (and may require a higher payment for compliance in the

future). Consequently, if the buyer wants to enforce agreements using relational contracting in the future, he may find it necessary to continue sourcing from the supplier during a drop in demand even though it is costly in the short run. The options for a buyer that only sources locally may be limited to incurring excess inventory and debt. However, a buyer that sources from several countries with different levels of contract enforcement has the option of reducing orders from suppliers in countries where he does not need to rely on relational contracting, and shifting orders to the suppliers in countries where he does. Even when this incurs costs, it is likely to be less expensive than incurring excess inventory, particularly in industries where preferences change rapidly. Thus, using relational contracting to overcome weak institutions can have a substantial impact on how a buyer conducts international sourcing, particularly when economic conditions fluctuate.

1.2.2 Introduction to the Model

I create a formal model to investigate exactly the way in which relational contracting and economic fluctuations affect multi-country sourcing decisions. The foundation of the model is an incomplete contracting model (based on the toy model described in Che Hausch 1999) that includes the strength of contract enforcement in the country where the supplier operates. Like Antras and Helpman (2004), I note the parallels between a situation where parties can not write a complete contract because of the nature of the transaction or uncertainty, and a situation where parties can write a complete contract, but can not get it enforced because of weak contract enforcement institutions.

The basic incomplete contracting model demonstrates that buyers are able to elicit greater effort and pay lower prices in countries with strong institutions, when they interact on a one-time basis. I then extend this model to an infinite-horizon setting and

find that buyers are able to elicit the same effort (albeit at a higher price) from suppliers in countries with weak institutions if the suppliers' discounted future return from complying with the agreement exceeds its returns from reneging. I then introduce a risk of negative shocks in every period and find that, if the likelihood of future shocks is sufficiently high, relational contracting becomes ineffective. Next, I examine a multi-country scenario where capacity constraints require the buyer to source from suppliers in separate institutional environments and determine the conditions under which it is optimal for the buyer to commit to always sourcing from the supplier in an institutional environment that does not enforce contracts. Crucially, I identify a threshold value for the risk of negative shocks. Below this value, it is optimal for a buyer to always source from the cheaper supplier in a country that does enforce contracts. Above this value, the buyer is better off committing to source from the more expensive supplier in the country that does not enforce contracts, in every period. Finally, I introduce differences in efficiency (i.e. cost) between the suppliers.

1.2.3 Foundation of the Model

Assume a buyer *B* wants to source one unit of a good from a supplier *S* to sell to a final customer, for a return $v(e)$.[1] Further, assume that the value to the final customer, $v(e)$[2], is a function of the effort *e* that the supplier spends on producing the good, and, for simplicity, that there are no other costs of production. The additional value from greater effort could be due to the product arriving in a timely manner before a shopping season or

[1] I assume that, due to intellectual property rights protection in the market that *B* serves, that the suppliers can not sell their good directly to the end customer.

[2] I further assume that this value function has typical properties, i.e. that it is continuously differentiable, strictly concave, and bounded. Also $v(0)=0$ and $v'(0)>1$.

a higher quality that the end consumer is willing to pay more for. Further, I assume that there are many suppliers and thus *B* can make a take it or leave it offer to *S* that indicates the level of effort *e* the supplier will expend and the price *p* that *B* will pay *S* for the good. Initially, I assume that all suppliers have the same cost of providing effort. I relax this assumption in Section 1.2.9.

Since *B* chooses *e* and *p* to maximize his surplus, he chooses $p=p^*$ such that *S* is just indifferent between producing and not producing the good, i.e. $p=e$ and chooses $e=e^*$ to maximize his surplus $(v(e)-p)=(v(e)-e)$. From the first order condition we can determine e^* such that $v'(e^*)=1$ and $p^*=e^*$. The buyer's total surplus is thus $v(e^*)-e^*$ while the supplier has zero surplus.

If *e* is not contractible, e.g. because the characteristics that are valuable to the final customer are not known at the time the agreement is made, then the level of *e* will not be specified in the contract and will be chosen by *S* to maximize his surplus. Since *S* can choose any level of *e*, for any price *p* that *B* offers, *S* will choose $e=0$. A better alternative for *B* in this scenario is to bargain with the supplier over the surplus ex-post, i.e. *B* is better off not offering any price but to agree to negotiate with *S* once the good has been produced. In keeping with the organizational economics literature, I assume that the parties negotiate over the ex-post division of surplus using Nash bargaining,[3] i.e. each party receives his outside option plus half of the surplus that is generated by the parties working together. Consequently *S* knows that, once he has expended effort *e* and the good is produced, he will get half of the surplus generated from selling the good to *B*

[3] For us, the necessary feature of Nash bargaining is that the supplier gains a fraction of the incremental surplus caused by his additional effort. Consequently, a wide range of alternative bargaining solutions can be used in this analysis with similar results.

during the ex post bargaining, i.e. $\frac{v(e)}{2}$ since *S* does not have any alternative buyers (and thus has no outside option).[4] *S* will therefore get a total surplus of $\frac{v(e)}{2} - e$ and chooses $= e_L$, the second best level of effort, to maximize this surplus. From the first order condition we find e_L is defined by $v'(e_L) = 2$, and thus we see that, with incomplete contracting, the chosen level of effort is less than in the first best since $e_L < e^*$. The payoff to *B*, $\frac{v(e_L)}{2}$ is also substantially less.

1.2.4 Variable Contract Enforcement

Now, instead of assuming that *e* can not be included in the contract because it is not known when the contract is written, assume that *e* is known but that the institutions that enforce contracts vary in the country where *S* is located. In this context *B* and *S* can write a contract, ex ante, in which they specify *e* and a price *p* that *B* will pay *S* for the good. If either party breaks the contract, i.e. if *S* does not expend effort *e* or is unwilling to sell the good at price *p*, or if *B* is unwilling to pay *p*, then the reneging party pays a fine α to a third party enforcer. α thus measures the strength of local contract enforcement and is high in high contract enforcement countries and low in countries with weak enforcement. If either party reneges on the contract then that party pays the fine and the parties bargain ex-post. If *B* reneges, then his payoff is $\frac{v(e)}{2} - \alpha$, while if *S* reneges then his payoff is $\frac{v(e)}{2} - e - \alpha$, which is maximized when $e = e_L$ as in the second best. Thus to prevent *S* from reneging, *B* would choose the lowest price *p*, such that *S* is indifferent

[4] Even with multiple buyers we assume that intellectual property protection in the country where the final consumer resides makes it impossible for *S* to sell the good to anyone but *B*.

between the total surplus he gets when complying and reneging, i.e. p such that $p - e = \frac{v(e_L)}{2} - e_L - \alpha$. Since, B would like to maximize $v(e) - p = v(e) - \left(\frac{v(e_L)}{2} - e_L - \alpha + e\right)$, B would like to choose $e = e^*$ as this maximizes his payoff.

However, in order for this offer to be credible, it must also be the case that B does not have an incentive to renege, i.e. the price offered must not be greater than what he would pay under ex post renegotiation, $p \leq \frac{v(e)}{2} + \alpha$. Combined, this gives us the constraint that:

$$\frac{v(e)}{2} + \alpha \geq \frac{v(e_L)}{2} - e_L - \alpha + e$$

$$\alpha \geq \frac{\frac{v(e_L)}{2} - e_L - \left(\frac{v(e)}{2} - e\right)}{2}$$

Since S's payoff is maximized when $e = e_L$, we know $\frac{v(e)}{2} - e \leq \frac{v(e_L)}{2} - e_L$. Thus without any external contract enforcement, $\alpha = 0$, it is impossible to sustain any level of effort other than the second best. At any level of enforcement greater than zero, a level of effort $e > e_L$ is sustainable and will be chosen by the buyer up to $e = e^*$. Additional enforcement does not increase sustainable effort beyond $\bar{\alpha} = \frac{\frac{v(e_L)}{2} - e_L - \left(\frac{v(e^*)}{2} - e^*\right)}{2}$. B's payoff varies from $\frac{v(e_L)}{2}$ to $v(e^*) - \left(\frac{v(e_L)}{2} - e_L - \bar{\alpha} + e^*\right)$.

This result implies that a buyer will, all else equal, always prefer to source from a supplier in a strong enforcement country over one in a weak enforcement country as he is able to obtain a lower price and higher effort. However, the buyer is indifferent between sourcing from suppliers in countries whose level of enforcement is above some threshold value.

The result that the price a buyer must pay when sourcing from a strong enforcement country is lower than the price when sourcing from a weak enforcement country is counterintuitive because, especially in international contract manufacturing firms usually outsource from countries with strong institutions to countries with weak institutions in order to lower their costs. In this model, the price that the buyer must pay has two components. The first component compensates the supplier for the cost of production, while the second component is a payoff that reduces the supplier's incentive to exploit the weak contracting institutions and renege. In this model I have not hitherto assumed that the cost of production varies between institutional environments and thus the first component of price does not vary. In contrast the second component varies inversely with the strength of local enforcement. In the real world we expect the cost of production to vary substantially across countries and suppliers. Thus, the increase in the price of sourcing a good from a country with weak institutions, may be offset by cheaper costs of manufacturing in that country. I introduce differences in costs between suppliers in different contract enforcement countries in Section 1.2.9.

1.2.5 Relational Contracting

Now assume that there is only one country to source from, *Weak*, and assume that this country does not enforce contracts at all, i.e. $\alpha = 0$.[5] The relational contracting literature (Klein and Leffler 1981, Axelrod 1984), notes that when parties work together repeatedly, a party may be coerced into complying because, if they renege, they will lose

[5] For further analysis of the effect on the model of an intermediate level of contract enforcement please see Appendix 4.1

a future premium rent stream that comes from working together in the future. This, "shadow of the future" ensures that the parties comply with the agreement.

In our context, assume that *B* needs a unit of good *S* in every period. If *B* promises to source one unit of the good *S* in every period, S will not renege if its payoff when reneging is less than the discounted infinite stream of future payments that it will get from *B* by complying. Since there are multiple identical suppliers *B* can credibly commit to never using *S* again if it reneges. Assuming that both *B* and *S* discount the future by the factor β, *S* will not renege on a contract (p, e) as long as:

$$\frac{v(e_L)}{2} - e_L \leq \sum_{t=0}^{\infty} \beta^t (p - e)$$

$$p \geq (1 - \beta)\left(\frac{v(e_L)}{2} - e_L\right) + e$$

Since, as before, *B* has all the bargaining power, *B* will choose the lowest price p such that *S* does not have an incentive to renege, i.e. $p = (1 - \beta)\left(\frac{v(e_L)}{2} - e_L\right) + e$. *B*'s total surplus per period is thus $v(e) - p = v(e) - e - (1 - \beta)\left(\frac{v(e_L)}{2} - e_L\right)$. B chooses e to maximize this surplus, and we see, from first order conditions that this occurs, as before when $e = e^*$. Since *B* would get a total surplus of $\frac{v(e_L)}{2}$ per period without a relational contract, *B* would only choose relational contracting if $v(e^*) - e^* - (1 - \beta)\left(\frac{v(e_L)}{2} - e_L\right) \geq \frac{v(e_L)}{2}$ which is true for all values of β.

The result is that, even when sourcing from a country with no contract enforcement, *B* can elicit first best effort from *S* by promising to source from *S* in the future, as long as *S* values the future sufficiently highly. The price that *B* must pay supplier *S* is, however, greater than sourcing from countries with strong enforcement.

1.2.6 Shocks

Now assume that, in every period, there is a risk of an i.i.d. shock.[6] When the shock occurs there is no longer any demand for the good in that period, and the probability that the shock will occur in any period is γ. In periods where *B* sources from *S*, the sum of *S*'s expected discounted future payment stream, if he does not renege, becomes:

$\sum_{t=0}^{\infty} \beta^t (1-\gamma)(p-e)$

i.e. *S* will not renege as long as

$\frac{v(e_L)}{2} - e_L \leq \frac{1-\gamma}{1-\beta}(p-e)$ which is equivalent to

$p \geq \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right) + e$

Again, since *B* has all the bargaining power, he chooses $p = \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right) + e$, and requires the supplier to expend effort $e = e^*$. However, the price *p* required to ensure this level of effort is $\frac{1}{(1-\gamma)}$ times higher than if there were no shocks. Consequently, the greater the likelihood of shocks, the higher the price the buyer must pay to ensure compliance. Importantly, the price may rise to the extent that it is inefficient to pay for compliance. *B*, will only choose compliance as long as the surplus he gets surpasses the surplus he gets when *S* reneges, i.e. $v(e^*) - p \geq \frac{v(e_L)}{2}$. Consequently it must hold that:

$$v(e^*) - \frac{v(e_L)}{2} \geq \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right) + e^*$$

[6] Independent and identically distributed, i.e. each shock has the same probability distribution and is statistically independent of all other shocks.

$$\gamma \leq \left(1 - \frac{(1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)}{\left(v(e^*) - e^* - \frac{v(e_L)}{2}\right)}\right) \quad \{1\}$$

Consequently, there exists a value $\bar{\gamma} = \left(1 - \frac{(1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)}{\left(v(e^*) - e^* - \frac{v(e_L)}{2}\right)}\right)$ where $0 \leq \bar{\gamma} < 1$ for which it is impossible for *B* to pay *S* enough to deter *S* from reneging. That is, with a sufficiently large risk of crises, it is not possible to use the shadow of the future to ensure first best effort. If $\gamma \leq \bar{\gamma}$, *B* can deter reneging and gets a surplus of $v(e^*) - e^* - \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right)$. If $\gamma > \bar{\gamma}$, then *B* can not deter reneging and gets $\frac{v(e_L)}{2}$ from ex-post bargaining.

1.2.7 Multi-country Sourcing

Now assume that there are two countries that *B* can source from. In one country, *Weak*, contracts are not enforced and there is no fine from reneging on a contract, i.e. $\alpha = 0$. In the other country, *Strong*, contracts are easy to enforce and the fine for reneging on the contract is sufficiently large such that no supplier in *Strong* ever reneges. Further, there are capacity constraints such that only one unit of the good can be produced in each country and *B* needs two units of the good per period. Even though only one unit of the good can be produced in each country, there are multiple suppliers in each country that *B* can turn to.[7]

In this scenario, *B* can write a contract with a supplier in *Strong*, S_s to get first best effort *e** at a price $p = e^*$, and *B* will have a total surplus of $v(e^*) - e^*$. To source from the supplier in *Weak*, S_W, *B* can either accept second best effort $e = e_L$ and get a

[7] Motivating example: All suppliers must hire from the same, limited labor pool.

surplus of $\frac{v(e_L)}{2}$ or promise to source from that supplier in all future periods paying $p = (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right) + e^*$, getting $e = e^*$, and getting a surplus of $v(e^*) - e^* - (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)$. Since $v(e^*) - e^* - (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right) > \frac{v(e_L)}{2}$ for all values of β, it is optimal for *B* to promise to source from the supplier in *Weak* in all future periods.

Now assume that a shock occurs such that *B* now only needs one unit of good in the current period. Furthermore, in all future periods there is now a probability γ, that the shock will reoccur reducing *B*'s need to one unit of the good in that period. In all other periods *B* will still need two units. *B* now has to choose which supplier he will source from during the current crisis and how to ensure that he will maximize his surplus in future periods. There are two different scenarios, $\gamma \leq \bar{\gamma}$ and $\gamma > \bar{\gamma}$, that determine his decision.

***Scenario 1:* $\boldsymbol{\gamma \leq \bar{\gamma}}$**

In this case, *B* must choose whether to source from S_S or S_W during the crisis. If *B* chooses S_S, he pays $p = e^*$ and gets surplus $v(e^*) - e^*$ in the current period. However, in the next period in which there is no crisis, *B* must source from S_W as well and must offer price $p = \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right) + e^*$, to deter him from reneging. *B's* discounted future payoff is thus:

$$\sum_{t=0}^{\infty} \beta^t \left(v(e^*) - e^*\right) + \sum_{t=1}^{\infty} \beta^t (1-\gamma)\left(v(e^*) - e^* - \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right)\right) \quad \{2\}$$

On the other hand *B* could choose to always source from the supplier in *Weak*, paying $p = (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right) + e^*$ in every period, and also sourcing from the

supplier in *Strong* in periods where there is no shock for price $p = e^*$. Using this strategy, B's discounted future payoff is:

$$\sum_{t=0}^{\infty} \beta^t \left(v(e^*) - e^* - (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)\right) + \sum_{t=1}^{\infty} \beta^t (1-\gamma)(v(e^*) - e^*) \quad \{3\}$$

However this payoff is unambiguously less. Subtracting {3} from {2} we get:

$$(1-\beta)(\frac{v(e_L)}{2} - e_L)$$

The result is unambiguously positive. Consequently when $\gamma \leq \bar{\gamma}$, i.e. the risk of future shocks is sufficiently small, *B* chooses to always use the supplier in *Strong* and employ the supplier in *Weak* only when there is no crisis.

Scenario 2: $\boldsymbol{\gamma > \bar{\gamma}}$

In this scenario, if *B* sources from S_S during the crisis, then, in the next period when there is no crisis, there is no price *p* that *B* can offer S_W to deter the supplier from reneging. (See Appendix 4.2 for an analysis of an alternate payment scheme in which *B* pays S_W both when sourcing and when not sourcing from S_W.) Consequently, *B* will get $v(e^*) - e^*$ in all periods and an additional $\frac{v(e_L)}{2}$ in periods when there is no crisis. *B's* discounted future payoff will thus be:

$$\sum_{t=0}^{\infty} \beta^t \left(v(e^*) - e^*\right) + \sum_{t=1}^{\infty} \beta^t (1-\gamma)\frac{v(e_L)}{2} \quad \{4\}$$

In contrast, if *B* sources from S_W during the crisis, and promises to keep sourcing from S_W, and only sources from S_S during periods when there is no crisis, *B's* payoff remains the same as in {3}, $\sum_{t=0}^{\infty} \beta^t \left(v(e^*) - e^* - (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)\right) + \sum_{t=1}^{\infty} \beta^t (1-\gamma)(v(e^*) - e^*)$

Subtracting {4} from {3} gives us $\frac{\beta(1-\gamma)}{1-\beta}\left(v(e^*) - e^* - \frac{v(e_L)}{2}\right) - \left(\frac{v(e_L)}{2} - e_L\right)$

which is large for large values of β, i.e. patient buyers and suppliers. It is also large when the value, to the buyer of first best effort $(v(e^*) - e^*)$ is large relative to the value of second best effort $\left(\frac{v(e_L)}{2}\right)$. Consequently, when the likelihood that future demand will be depressed in the future is large, when additional effort is valuable, and when the parties are patient, it is optimal for *B* to source from S_W on an ongoing basis and only source from S_S when demand is high, even though it is more costly to source from S_W than S_S.

1.2.8 Sourcing from Multiple Institutional Environments

With these two scenarios we can derive several conclusions about how firms use relational contracting when sourcing from different countries with different levels of contract enforcement. It also provides us with predictions as to how we would expect buyers to behave in response to economic fluctuations. In scenario 1, we saw that, when the risk of future crises is small, it is optimal for the buyer to always source from the supplier in the strong enforcement country and to only source from the supplier in the weak enforcement country when demand is high enough.

In this scenario, the supplier in *Weak* still provides first best effort because the price it receives in future periods, when there is no crisis, is high enough that it deters reneging, i.e. the weak institutions are overcome solely through relational contracting. This scenario also allows for substantial flexibility because the buyer can also stop ordering from the supplier in the strong enforcement country should a new, cheaper alternative present itself, without affecting the incentives to renege for any of the suppliers. If we were in scenario 1 – when looking at a snapshot of sourcing data at the

moment a crisis happened – we would see the buyer stop sourcing from the supplier in the weak institution country and, equivalently, stop sourcing from his most expensive supplier. We would also see buyers start sourcing from new, cheaper, suppliers.

In contrast, in scenario 2, we see that when the risk of crises is high, the buyer does better by committing to source from the supplier in the weak enforcement country at all times, and only sources from the supplier in the strong enforcement country when demand exceeds the capacity of the weak enforcement supplier. By making this commitment, the value of future business to the supplier in *Weak* becomes sufficiently high that he loses the incentive to renege and supplies greater effort. However, though the buyer is able to use relational contracting to overcome weak institutions, he has substantially less flexibility than in scenario 1. Any reduction in orders to the supplier in weak, or likelihood of future reductions, reduces the future value of the relationship and increases the price the buyer must pay in order to ensure the supplier provides a high level of effort. If the future value of the relationship is reduced too much, relational contracting breaks down and the buyer can only get second best effort from this supplier. Consequently, the buyer is more restricted in his ability to take advantage of opportunities to source from other cheaper suppliers, especially during a crisis when such suppliers are particularly likely to be available. If we were in this scenario, at the time a crisis occurred we would see buyers continuing to source from their suppliers in weak enforcement countries and stop sourcing from their suppliers in strong enforcement countries. Equivalently, we would see them continue sourcing from their higher priced suppliers over their cheaper ones. Further, buyers would be less likely to source from new low-cost suppliers.

Hypothesis 1: When, during a crisis, buyers stop sourcing from their suppliers in strong institution countries and continue sourcing from their suppliers in weak institution countries, we are in scenario 2, implying that relational contracting is reducing buyer flexibility.

1.2.9 Supplier Cost/Efficiency Differences

So far in this analysis I have assumed that all suppliers have the same costs, i.e. it costs all of them the same effort *e* to generate value *v(e)* for the buyer. In the context of global supplier networks, this is unrealistic as costs typically vary across firms and locations. In this section I investigate how my results change when I introduce differences in efficiency – or, equivalently, cost – between the suppliers.

Let us assume that there are two suppliers, an inefficient supplier that, as before, expends effort *e* to generate value *v(e)* to the buyer *B*, and an efficient supplier that can create value *v(e)* using a fraction of the effort of the inefficient supplier, i.e. $\frac{e}{\theta}$ where $\theta > 1$. In the context of my model, there are now two cases to consider. In the first case the efficient supplier is in *Weak* while the inefficient supplier is in *Strong*. I consider the alternate case, where the inefficient supplier is in *Weak* while the efficient supplier is in *Strong* in Appendix 4.3.

The case where the efficient supplier is in *Weak* (S_W^e) and the inefficient supplier is in *Strong* (S_S^i), corresponds more closely with scenarios in global outsourcing, where costs are typically lower in countries with weak contract enforcement institutions. This case is substantially different from the original analysis because the optimal, second-best, effort supplied by S_W^e changes. Now that he is more efficient, his payoff, when he reneges, is $\frac{v(e)}{2} - \frac{e}{\theta}$ and thus he would chose $e = e'$ such that $v'(e') = \frac{2}{\theta}$. Since $v'(e_L) = 2$, in this

new scenario, the second best effort by the supplier in *Weak* increases, i.e. $e' > e_L$, as does his payoff when reneging since $v(e') > v(e_L)$. Consequently, the price demanded by this supplier in order for him not to renege changes. *B* again sets the price such that this supplier is indifferent between his expected future benefit of complying and reneging. In the case where S_W^e is just being used in times when there is no crisis, this price is set by the equation:

$$\sum_{t=0}^{\infty} \beta^t (1-\gamma)\left(p - \frac{e^*}{\theta}\right) = \frac{v(e')}{2} - \frac{e'}{\theta}$$

i.e.

$$p = \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e')}{2} - \frac{e'}{\theta}\right) + \frac{e^*}{\theta} \quad \{5\}$$

However, as before, *B* and S_W^e will only agree to this price if *B* does not have an incentive to renege. Thus the price must be low enough that *B*'s return if he does not renege is must be at least as large as when he does, i.e.

$$v(e^*) - p \geq \frac{v(e')}{2} \quad \{6\}$$

Combining {6} with {5} we can again solve for γ:

$$\gamma \leq 1 - \frac{(1-\beta)\left(\frac{v(e')}{2} - \frac{e'}{\theta}\right)}{v(e^*) - \frac{e^*}{\theta} - \frac{v(e')}{2}} \quad \{7\}$$

Which gives us a new threshold value $\overline{\gamma'} = 1 - \frac{(1-\beta)\left(\frac{v(e')}{2} - \frac{e'}{\theta}\right)}{v(e^*) - \frac{e^*}{\theta} - \frac{v(e')}{2}}$. When the risk of crisis is above this threshold level, there is no price *p* that *B* can credibly offer S_W^e in order to prevent *Weak* from reneging. Further, when we compare {7} to {1}, we see that this new threshold is lower than the threshold when both suppliers are equally efficient,

i.e. $\overline{\gamma'} < \bar{\gamma}$, and the difference is increasing in θ. In the previous section we saw that this threshold defines the ranges in which the supplier in *Strong* is always chosen and the supplier in *Weak* is only chosen when there isn't a crisis, and the range in which *B* promises to always source from *Weak* and only uses the supplier in *Strong* when demand is high. Consequently, the greater the difference in costs and efficiency between the two suppliers, the greater the likelihood that *B* will make a long term promise to always source from the supplier in *Weak*, i.e. the greater the likelihood that we are in scenario 2 above. In the context of my data I thus expect that when the difference in costs (wages, raw materials, etc.) is high between suppliers, then suppliers in countries with weak contract enforcement will be preserved at the expense of suppliers in countries with strong contract enforcement, or, equivalently, suppliers in high cost countries will be dropped during the crisis much more frequently than suppliers in low cost countries.

Hypothesis 2: The larger the difference in costs between suppliers in weak and strong enforcement countries, the greater the likelihood that we are in scenario 2 and relational contracting reduces buyer flexibility in choosing who to source from.

1.3 Empirical Design

My model suggests that firms that source similar goods[8] in countries with different contracting institutions – and rely on relational contracting in countries with weak institutions – find themselves unable to optimally reconfigure their supplier networks when faced with a crisis and a likelihood of crises in the future. In these

[8] My model assumes that the suppliers a buyer is choosing between provide it with a similar value *v(e)* and that the way this value varies with effort is the same. If these conditions hold the suppliers could be providing entirely different goods. To ensure that my empirical results are robust to differences in products I try to control for product type in Section 1.5.3.

situations they must continue sourcing from weak institution countries in order to prevent these suppliers reneging on their agreements, at the expense of potentially cheaper suppliers in strong institution countries. Consequently, this drawback of using relational contracting will manifest itself when there is an unexpected shock that changes participants' expectations of likelihood of current and future crises, and be most noticeable for buyers who source from suppliers in vastly different institutional environments.

An important consideration in this analysis is the duration of a relationship between a buyer and a seller. A long prior relationship may be an indication of a long-term implicit commitment by a buyer to a seller, have led to learning or other relationship specific investments that increase the value of the relationship to the buyer versus other relationships, or another form of private enforcement mechanism in which the parties develop a "trust" that makes reneging more emotionally costly and the relationship more valuable.

To test for the drawback to using relational contracting in a multi-country setting I use a unique set of international contract manufacturing purchase orders during the time of the financial crisis and estimate the impact of contracting institutions and relationship history on the likelihood that a relationship between a buyer and a supplier, from a given country, in a given year, was terminated.

1.3.1 Data

International contract manufacturing is an excellent setting to study the interactions between relational contracting and formal contract enforcement, for several reasons. Firstly, there is significant variation in contract enforcement institutions across

countries – much more than we find within most countries. Secondly, in many industries, buyers do little or no in-house manufacturing allowing us to disregard the confounding decision of whether to manufacture in-house or outsource. Thirdly, the fact that each buyer typically transacts with multiple suppliers allows us to separate the characteristics of the buyer from the characteristics of the relationship. An additional benefit is the fact that buyers and, increasingly, suppliers can span multiple institutional environments and it is one of the few areas in which we can get accurate data on emerging market multinational firms.

For my purposes, looking at this data before and during the financial crisis is particularly valuable because the financial crisis creates a quasi-natural experiment. The crisis was an exogenous shock that greatly affected the demand for the products offered by western buyers in many industries that, in turn, forced them to make choices about which suppliers to continue sourcing from. Buyers were forced to weigh the value of keeping relationships that were important for the future against the need for immediate cost savings.

The problem, however, is that international contract manufacturing data, and outsourcing data more broadly, is scarce because it is typically confidential and needs to be acquired on a company-by-company basis. Consequently, most research that has been done has either looked at domestic outsourcing – for which there is little institutional variation – or the activities of multinationals abroad – which contains little information about their relationships with third parties.

To overcome these difficulties I worked with a provider of cloud-based software that manages sourcing and provides financing services for many large global brands.

These firms typically manage all of their sourcing via this software, and all information about their purchase orders, from ordering through shipment, and then invoicing and payment is transmitted and processed by the software. The purchase orders used in this investigation contained data on the buyer, supplier, country of origin (i.e. country in which the goods were last processed), price per unit, date the order was generated and latest shipping date, payment terms and customs classification.

In this chapter I analyze the purchase orders of 28 primarily US-based buyers with all of their 668 suppliers across 56 countries from 2007-2009. These buyers conducted $5.2bn in transactions with these suppliers in 2007 and reduced their orders to these suppliers to $2.3bn in 2009. The buyers were primarily in the apparel (12 companies), sportswear (4), and footwear (3), industries, but there were also buyers in the toys (1), sporting goods (2), furniture (1), confectionary (1) and autoparts(1) industries.

My analysis focuses on whether a buyer terminates or reduces orders from a supplier from a given country of origin. Consequently orders are aggregated to the buyer-supplier-country level by year, i.e. how much a given buyer sourced from a given supplier in a given country per year from 2007 through 2009. (See Section 1.5.3 for an analysis with orders aggregated to the buyer-supplier-country-2 digit HTS code level.)

1.3.2 Empirical Model

I use logistic regression to examine the impact of the contract enforcement environment in the country of origin and the prior duration of the relationship, on the likelihood that the buyer terminated a given relationship with a given supplier for products manufactured in a given country of origin in a given year. Consequently, the model I estimate is:

$$Terminated_{BSct}$$

$$= f(\beta_1 C_{ct} + \beta_2 R_{BSt-1} + \beta_3 Q_{BSt-1} + \beta_4 P_{BSct-1} + \zeta_B + \eta_t + \vartheta_p + \varepsilon_{BSct})$$

Here, $Terminated_{BSct}$ is the dependent variable that indicates whether or not a buyer *B* stopped sourcing from a supplier *S* in a given country *c* in year *t* relative to the year before. C_{ct} is a variable that measures the strength of contract enforcement institutions in country *c* in year *t*. R_{BSt-1} measures the length of the relationship between buyer *B* and supplier *S* up until the prior year. Q_{BSt-1} measures the number of countries that supplier *S* supplies buyer *B* from in the prior year. P_{BSct-1} measures the order value-weighted price per unit of goods shipped to the buyer, by the seller, from the given country of origin, in the prior year. ζ_B, η_t, and ϑ_p are sets of dummy variables corresponding to buyer firm, year, and product category fixed effects. ε_{BSct} is the error term. I use logistic regression because my dependent variable is a binary variable and because the results are easier to interpret when the coefficients are reported in odds ratio form.[9] Table 1.1 shows the descriptive statistics for these variables, while Table 1.2 shows the correlations between them.

[9] In my analysis logistic regression is also equivalent to evaluating a Cox proportional hazards model as there are no instances in my data in which a relationship that has been terminated is reinitiated and re-terminated.

Table 1.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Terminated	2,807	0.40	0.49	0	1
Contract Viability	2,807	2.95	0.56	0.5	4
Property Rights	2,807	35.76	24.68	5.0	95
Relationship Duration, 2007-2009	2,807	1.37	0.48	1	2
Relationship Duration, 2003-2009	2,807	2.42	1.47	1	6
Buyer Supplier Countries	2,807	1.83	2.20	1	18
MNC Flag	2,807	0.50	0.50	0	1
Price	2,807	16.46	33.67	0.00577	1023

Table 1.2: Correlations

	Terminated	Contract Viability	Property Rights	Rel. Duration, 07-09	Rel. Duration, 03-09	Buyer Supplier Countries	MNC Flag	Price
Terminated	1							
Contract Viability	-0.005	1						
Property Rights	0.049	0.736	1					
Relationship Duration, 07-09	0.112	0.037	0.033	1				
Relationship Duration, 03-09	-0.141	0.184	0.139	0.454	1			
Buyer Supplier Countries	0.032	0.170	0.206	0.068	0.077	1		
MNC Flag	-0.058	0.217	0.234	0.110	0.252	0.382	1	
Price	-0.010	-0.070	-0.083	0.034	-0.065	-0.088	-0.063	1

1.3.3 Dependent Variable

Terminated: This variable measures whether a buyer stopped sourcing from a given supplier in a particular country of origin. Terminated is set to zero if the buyer sourced a positive amount from the supplier in the given country of origin in the current year. It is set to one if the buyer did source a positive amount from the supplier in that country of origin in the prior year, but did not source at all from this supplier-country pair in the current year. The variable is created for all buyer-supplier-country triad in 2008 and 2009. 2007 observations are dropped because many independent variables and controls are lagged.

1.3.4 Independent Variables

Contract Viability: I use the Contract Viability variable from the International Country Risk Guide (PRS Group 2011) to measure the strength of the contract enforcement institutions in the country of origin. This variable measures "the risk of unilateral contract modification and, at worst, outright expropriation of foreign assets" and ranges from 0.5 to 4 for the countries in this sample, where four indicates the strongest enforcement of contracts. While the measure is available monthly, I average it by year for this analysis.[10] I use this measure of contract enforcement both because it is commonly used in the academic literature and is, arguably, the most granular metric available for a large sample of countries that is consistently measured over long time periods. In the robustness section I re-conduct this analysis using alternative institutional measures, particularly the Heritage Foundation's index of property rights (Heritage Foundation 2011) which measures both property rights and the ability of firms to enforce contracts in the courts.

Relationship Duration: This variable measures the number of years that a buyer sourced from a given supplier (irrespective of country of origin) from 2007 up until the prior year of the observation. Consequently, if, for a buyer-supplier pair in 2008, there had been orders between that buyer and that supplier in 2007, Relationship Duration would be set to 1. If, for a buyer-supplier-country pair in 2009, there were orders in 2008 and 2007, Relationship Duration would be set to 2. Though there is reason to think that the last year to two years does convey information about the relationship, this measure

[10] Out of the 56 countries in the sample, in only one country did *Contract Viability* change more than once per year between 2007-2009. In this country, Mongolia, *Contract Viability* temporarily dipped from 3 to 2.5 in 2007, fell from 3 to 2.5 and then 2 in 2008, and fluctuated between 2 and 2.5 in 2009.

only weakly captures the prior history of a relationship. Therefore, in the robustness section I re-conduct this analysis measuring the history of the relationship going back to 2003.

Buyer Supplier Countries: This variable measures the number of countries in which a supplier manufactures products for a given buyer, in the prior year. I include this variable to control for the fact that buyers may be less willing to terminate relationships with suppliers that they source from across several countries.

1.3.5 Controls

Price: Buyers would be expected to stop orders from higher priced suppliers than cheaper priced suppliers. Consequently, I include the order value-weighted average price per unit, in US dollars for all purchase orders for the buyer-supplier-country pair in the year prior to the observation. Orders that were not in US dollars were converted using annual exchange rates from www.oanda.com.

1.4 Empirical Results

As a first step in my analysis I conduct a series of means comparisons to see whether my independent variables have a substantial impact on whether or not a relationship was terminated. I classified countries as either strong contract enforcement countries or weak contract enforcement countries using the median value of Contract Viability and Property Rights for the countries in my sample. I classified countries as "High Contract Viability" if they had a Contract Viability value greater than the median (3.5) and "Low Contract Viability" otherwise. Similarly, I classified countries as "High Property Rights" if they had a value greater than the median (50) and "Low Property Rights" otherwise. I then allocated my observations between these categories depending

on the institutions of the country, and conducted t-tests on the mean of *Terminated* between the groups. In both cases the number of observations in the weak category far outweighed the number in the strong category because more sourcing in my sample was conducted with countries with weak contract enforcement institutions. I report these results in Table 1.3. Here we see that the average observation was terminated 38.6% of the time in countries with at or below median Contract Viability, and 47.9% of the time in countries with above median Contract Viability. A t-test of these means showed the difference to be significant below the 1% level. Similarly, observations were terminated 38.8% of the time in countries with at or below median Property Rights, and 43.5% of the time in countries with above median Property Rights. Again, a comparison of these means showed the difference to be significant below the 1% level. Both of these comparisons conform to my predictions in hypothesis 1.

Table 1.3: Comparison of Means (t-tests) by Contract Viability, Property Rights, and Relationship Duration

Variable	N	Average of *Terminated*	t Statistic	Mean of *De-Meaned Terminated*	t Statistic
Weak Contract Viability	2496	0.3866	-3.15	-0.0127	-4.66
Strong Contract Viability	311	0.4791		0.1016	
Weak Property Rights	2270	0.3877	-2.05	-0.0204	-5.45
Strong Property Rights	537	0.4358		0.0861	
2+ year relationship	1033	0.4685	5.96	-0.0124	-1.22
1 year relationship	1774	0.3551		0.0072	

Note: *De-meaned Terminated* is calculated by subtracting the average share of *terminated* at the buyer-year level

I also separated observations by whether the relationship[11] had existed for just one year or whether the relationship had persisted for two or more years. Here observations

[11] The buyer had sourced from that supplier in that country previously.

were terminated 46.9% of the time when the relationship had persisted for two or more years and 35.5% of the time when the relationship had only existed for one year. This is puzzling given that we would expect the value of commitment to be higher the longer a relationship has existed since a supplier's expectations of the future value of a relationship are strengthened by prior interaction, as documented in Poppo et al. (2008). However, a significant problem with these averages is that they do not account for the fact that these relationships were terminated or kept by different buyers in different years. Consequently, if, for example, a particular buyer had exclusively longer relationships and had to terminate them because of financial trouble this would increase the mean in the long relationship category but not because he was more likely to keep suppliers with which he had shorter relationships. To address this problem, I calculate the share of observations terminated by each buyer-year pair and subtract this from the *Terminated* value for each observation. I then used these de-meaned values for *Terminated* and re-conduct the means tests in this table. The results are in the fifth column in Table 1.3. Here we see that our results remain the same when I split the sample by median country Contract Viability and Property Rights (the mean in the strong group is higher than the mean in the low group, and the difference is significant). However, when I split the group by relationship duration we find that a higher share of shorter relationships were terminated than longer relationships. The difference between the means for relationship duration was, however, not statistically significant.

To get a clearer picture of how these various factors affected the likelihood that a relationship was terminated I ran a series of regressions using my empirical model from Section 1.3.2. Because I suspect that different buyers were affected differently by the

crisis and that the likelihood that a relationship was terminated depended on how far the crisis had progressed, I include buyer and year fixed effects in all of my regressions. Further, because I expect errors to be correlated between observations with the same buyer, I cluster errors at the level of the buyer. (See Section 1.5.3 for regressions including product and country fixed effects and clustering at the country level). In all tables in this chapter, coefficients are reported as odds ratios.[12]

I present my first results in Table 1.4. In regressions ii-iv we see that a one point increase in Contract Viability made it 1.5-1.52 times more likely that the relationship would be terminated. In regressions iii-iv we see that longer relationships were less likely to be terminated. Relationships that had persisted for two years or more were between 1.54-1.56 times[13] less likely to be terminated than relationships that had only persisted for a year. The number of countries a supplier manufactured goods in for a buyer was not a statistically significant predictor of whether a relationship was terminated, as we see in regression iv. Also, in all of these regressions I did not find a statistically significant relationship between price and whether a relationship was terminated. Consequently, these initial results provide strong evidence for hypothesis 1. Buyers were much more likely to terminate their relationships with suppliers in countries where contract enforcement institutions were strong and less likely in countries where institutions were weak. Further, the importance of the contracting environment far outweighs cost considerations. Combined, these results suggest that buyers were in a situation similar to

[12] A coefficient value above 1 indicates that an increase in the independent variable makes the dependent variable more likely and vice versa.

[13] 1/0.642 to 1/0.650

scenario 2 where their reliance on relational contracting was hindering their flexibility in optimally reconfiguring their supplier networks in response to the financial crisis.

Table 1.4: Logit of Terminated on Independent Variables

	i	*ii*	*iii*	*iv*
Contract Viability		1.498	1.517	1.524
		[3.66]***	[3.64]***	[3.68]***
Relationship Duration			0.642	0.650
			[2.01]**	[1.93]*
Buyer Supplier Countries				0.974
				[0.88]
Price	0.997	0.997	0.997	0.997
	[1.51]	[1.58]	[1.50]	[1.51]
N	2901	2807	2807	2807
Pseudo R2	0.21	0.22	0.22	0.22
Log pseudolikelihood	-1,552	-1,480	-1,476	-1,476

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

I next look at the interactions between my main independent variables, Contract Viability and Relationship Duration. To facilitate the interpretation of the coefficients of the interaction term I centered both variables. Further, I multiplied the centered Contract Viability by negative one so that a large value would indicate a weak environment. The results of this regression are presented in Table 1.5. Contract Viability and Relationship Duration remain significant and have the same directional impact on whether a relationship is terminated or not. However, the interaction between the negative Contract Viability and the Relationship Duration is not significant. Consequently, I do not find evidence that a longer relationship made it less likely that a relationship was terminated in a weak contract enforcement country than in a strong contract enforcement country.

Table 1.5: Logit of Terminated on Contract Viability, Relationship Duration, and Interactions

	2007-2009 Sample
Negative Contract Viability (centered)	0.511
	[3.62]***
Relationship Duration (centered)	0.642
	[2.03]**
Neg Contract*Relationship	1.386
	[1.48]
Price	0.997
	[1.48]
N	2,807
Pseudo R2	0.22
Log pseudolikelihood	-1,474

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

1.4.1 MNC Suppliers

One element of my empirical setting that was not addressed in the model is that a growing number of suppliers in international contract manufacturing have operations in multiple countries. In this data, many suppliers manufacture for the buyers across different countries. In 2007, 54% of buyer-supplier-country triads involved multinational (MNC) suppliers. There are many reasons to believe that these MNC suppliers are affected by local contracting institutions differently than local-only suppliers (see Chapter 2 for an extensive investigation of this issue). Specifically, due to the ability to enforce contracts against a MNC supplier in a country other than the local country, and due to the ability to punish a MNC supplier for reneging on an agreement by terminating orders with him in other countries or damaging his reputation in other markets, we might expect MNC suppliers to be treated similarly to suppliers based in strong enforcement countries, i.e. their orders would be terminated much more frequently than local-only suppliers, particularly in weak contract enforcement countries. I thus run a series of regressions,

similar to those in Table 1.4, including a dummy variable indicating whether the supplier was a MNC or local-only supplier (*MNC Flag*). The supplier was categorized as a MNC if he had offices in more than one country, shipped from more than one country, or had offices in a different country than the country shipped from. In all other cases the supplier was classified as local-only.

The results of my regressions when I include the MNC status of the supplier are presented in Table 1.6. In regressions ii-iv we see that the coefficients on *Contract Viability* stay virtually identical to the coefficients in Table 1.4 in terms of direction, significance and magnitude. Similarly, the coefficients on *Relationship Duration* stay very similar, though the significance of *Relationship Duration* in regression iii in Table 1.6 falls to the 10% significance level from the 5% significance level in Table 1.4. However, the coefficient on *MNC Flag* is not significant across these regressions. I interpret these results to suggest that MNC suppliers were not treated differently from local-only suppliers when it came to the decision whether or not to stop ordering from them during the financial crisis. To ensure that the MNC status of a supplier is not a significant consideration I include *MNC Flag* as a control in the remainder of the regressions where appropriate.

Table 1.6: Logit of Terminated on MNC Flag and other Independent Variables

	i	*ii*	*iii*	*iv*
MNC Flag	0.870	0.788	0.812	0.823
	[0.94]	[1.60]	[1.37]	[1.30]
Contract Viability		1.534	1.547	1.549
		[3.78]***	[3.77]***	[3.79]***
Relationship Duration			0.669	0.671
			[1.81]*	[1.78]*
Buyer Supplier Countries				0.988
				[0.36]
Price	0.997	0.997	0.997	0.997
	[1.51]	[1.59]	[1.51]	[1.51]
N	2,901	2,807	2,807	2,807
Pseudo R2	0.21	0.22	0.22	0.22
Log pseudolikelihood	-1,551	-1,477	-1,474	-1,474

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

1.5 Robustness Checks

While my results suggest that buyers were strongly influenced by contract enforcement considerations when choosing which suppliers to terminate relationships with during the financial crisis, there are several aspects of my analysis that are a cause of concern. Firstly, my main independent variable *Contract Viability* may not be an accurate measure of contract enforcement. Secondly, buyers could be making their decisions based on other institutions that contract enforcement happens to be correlated with, or a country's overall level of development. Thirdly, it could be the case that buyers are keeping suppliers not based on relational contracting considerations but instead based on changes in demand for different types of products. Alternatively, my measurement of the duration of the relationship may consider an insufficiently long period of time. It could also be the case that other factors at the country level are driving my results. Finally, it could also be the case that suppliers in countries with strong contract enforcement

institutions went out of business during the financial crisis and stopped being available as suppliers. I conduct a series of robustness checks below to address these issues.

1.5.1 Alternate Measures of the Contract Enforcement

One area of concern is that *Contract Viability* may be constructed such that it only weakly measures contract enforcement institutions but is correlated with another underlying institution which buyers are reacting to. To allay this concern I re-run my regressions in Table 1.4 replacing *Contract Viability* with the Heritage Foundation's index of *Property Rights*. This index measures "the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses … the ability of individuals and businesses to enforce contracts." I present the results of this regression in Table 1.7. The coefficient on *Property Rights* remains highly significant in all of the regressions and the other results are largely identical to the results in Table 1.4. The only substantial difference is that the coefficient on *Property Rights* is much smaller. This is, in part, because *Property Rights* is scaled from 0 to 100, and is also because the index measures property rights protection in addition to contract enforcement. These regressions imply that a ten point increase in Property Rights makes it 1.15 times[14] more likely that a relationship will be terminated.

[14] 1.014^10

Table 1.7: Logit of Terminated on Property Rights and other Independent Variables

	i	*ii*	*iii*	*iv*
Property Rights	1.014	1.014	1.014	1.015
	[5.64]***	[5.63]***	[5.68]***	[5.65]***
Relationship Duration		0.681	0.691	0.710
		[1.88]*	[1.77]*	[1.65]*
Buyer Supplier Countries			0.972	0.983
			[1.19]	[0.62]
MNC Flag				0.848
				[1.15]
Price	0.997	0.997	0.997	0.997
	[1.70]*	[1.63]	[1.64]	[1.64]
N	2,890	2,890	2,890	2,890
Pseudo R2	0.22	0.22	0.22	0.22
Log pseudolikelihood	-1,518	-1,515	-1,514	-1,513

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

1.5.2 Alternate Institutions

Another area of concern is my choice of institution. It could be the case that buyers are not reacting to contracting institutions but another institution with which contract enforcement institutions are correlated. To address this I first select five other variables from the International Country Risk Guide that are likely to affect sourcing performance in a country. These five variables measure the ease of repatriating profits (*Repatriation*), the risk of payment delays (*Payment Delays*), prevalence of corruption (*Corruption*), quality of government and regulatory agencies (*Bureaucratic Quality*), and the strength of law and order (*Law & Order*). Since these institutional measures are highly correlated with each other and *Contract Viability*, I orthogonalized them and used them together with *Contract Viability* as independent variables in a logistic regression with *Terminated* as the dependent variable. I present the results in Table 1.8. In this regression we see that only *Contract Viability* and *Repatriation* are significant. Further, the coefficient on *Contract Viability* is larger. Since it is implausible that buyers made

their decision whether to keep sourcing from a supplier based on the ease of transferring money *out* of the host country, I interpret these results to suggest that contracting institutions were the key institutions explaining which suppliers were kept.

Table 1.8: Logit of Terminated on Orthogonalized Institutions

Repatriation (orthogonalized)	1.147
	[3.16]***
Payment Delays (orthogonalized)	0.995
	[0.08]
Corruption (orthogonalized)	1.020
	[0.26]
Bureaucratic Quality (orthogonalized)	1.047
	[0.84]
Law & Order (orthogonalized)	0.914
	[1.29]
Contract Viability (orthogonalized)	1.286
	[3.98]***
Price	0.997
	[1.63]
N	2,807
Pseudo R2	0.22
Log pseudolikelihood	-1,473

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

We might also be worried that firms are primarily responding to changes in local wages and are terminating relationships in countries where average wages increased. This could explain my results if wages in countries with strong contract enforcement also experienced increases in wages, and wages in countries with weak institutions decreased. To examine this I rerun my analysis including data on the annual percentage change in average real wages per country (*Change in Wages*) from the Economist Intelligence Unit (EIU 2011). The results are presented in Table 1.9. The coefficient on *Change in Wages* in regression i suggests that relationships were actually *less* likely to be terminated when wages *increased*. Further, when including institutions and my other independent variables,

the statistical significance of the change in wages disappears. The other results remain similar to my earlier findings except that the significance on the coefficient on Contract Viability is reduced to the 10% level when the *Change in Wages* is included.

Table 1.9: Logit of Terminated on Change in Wages and Other Independent Variables

	i	ii	iii	iv	v
Change in Wages	0.973	0.992	0.992	0.990	0.991
	[3.87]***	[0.62]	[0.66]	[0.78]	[0.73]
Contract Viability		1.397	1.409	1.400	1.431
		[1.77]*	[1.76]*	[1.73]*	[1.87]*
Relationship Duration			0.637	0.644	0.664
			[2.06]**	[1.97]**	[1.82]*
Buyer Supplier Countries				0.972	0.985
				[0.94]	[0.44]
MNC Flag					0.831
					[1.23]
Price	0.998	0.997	0.997	0.997	0.997
	[1.52]	[1.60]	[1.51]	[1.51]	[1.52]
N	2,762	2,762	2,762	2,762	2,762
Pseudo R2	0.22	0.22	0.22	0.22	0.22
Log pseudolikelihood	-1,455	-1,451	-1,448	-1,447	-1,446

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

It could also be the case that *Contract Viability* and *Property Rights* are proxying for the level of development of the host country. This is an especially large concern because both variables are highly correlated with GDP per capita. To address this, I orthogonalize Contract Viability and Property Rights, separately, with GDP per capita and total GDP, and regress them in pairs together with the other variables from the full empirical model. I present the results in Table 1.10 and they are largely similar to the results in the full model. Both *Contract Viability* and *Property Rights* remain highly significant in all of the regressions. As a result of the orthogonalization the magnitude of the coefficient on *Contract Viability* is slightly diminished, and the magnitude of the

coefficient on *Property Rights* is greatly increased. The only measure of GDP that is significant is GDP per capita, and only in regression i.

Table 1.10: Logit of Terminated on Institutions and GDP

	i	*ii*	*iii*	*iv*
Contract Viability (orthogonalized)	1.294		1.296	
	[4.07]***		[3.87]***	
Property Rights (orthogonalized)		1.454		1.451
		[5.06]***		[5.11]***
GDPpc (orthogonalized)	1.218	1.011		
	[4.58]***	[0.21]		
GDP (orthogonalized)			0.992	0.946
			[0.16]	[1.21]
Relationship Duration	0.734	0.752	0.711	0.745
	[1.35]	[1.31]	[1.45]	[1.35]
MNC Flag	0.811	0.861	0.824	0.855
	[1.39]	[0.96]	[1.19]	[0.98]
Price	0.997	0.997	0.997	0.997
	[1.54]	[1.69]*	[1.49]	[1.65]*
N	2,662	2,743	2,662	2,743
Pseudo R2	0.22	0.22	0.22	0.22
Log pseudolikelihood	-1,391	-1,435	-1,399	-1,434

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

1.5.3 Alternate Controls

Yet another area of concern is that buyers source different types of products from strong institution countries than in weak institution countries. Consequently, buyers may be terminating relationships in strong institution countries because demand for those products has declined more than the demand for the type of products sourced from weak institution countries. To investigate this concern I look at the sub-sample of my data that includes Harmonized Tariff Schedule (HTS) codes. I aggregate the orders to the buyer-supplier-country-2 digit HTS code level by year and estimate the model using this data. I present the results of this analysis in Table 1.11. The results are broadly consistent with the initial analysis except that the significance of many variables is slightly diminished.

Contract Viability is only significant at the 5% level and the magnitude of the coefficient is diminished. Both the significance and magnitude of the coefficient on *Relationship Duration*, in all of the regressions increases.

Table 1.11: Logit of Terminated on Independent Variables, HTS Sample

	i	*ii*	*iii*	*iv*	*v*
Contract Viability		1.387	1.372	1.370	1.416
		[2.26]**	[2.18]**	[2.17]**	[2.37]**
Relationship Duration			0.456	0.465	0.522
			[2.68]***	[2.59]***	[2.16]**
Buyer Supplier Countries				0.978	0.995
				[0.71]	[0.16]
MNC Flag					0.737
					[1.77]*
Price	0.998	0.999	0.999	0.999	0.999
	[0.45]	[0.17]	[0.16]	[0.17]	[0.31]
N	1,272	1,223	1,223	1,223	1,223
Pseudo R2	0.25	0.26	0.27	0.27	0.27
Log pseudolikelihood	-654	-617	-614	-613	-612

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer, year, and product (2 digit HTS code) fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

Another issue regards my measurement of *Relationship Duration* seeing as it only measures the number of years a buyer-supplier pair have worked together from 2007 to the current year. To address this I re-conducted my analysis using the subset of firms for which data was available going back to 2003. I present the results of this analysis in Table 1.12. Here, *Relationship Duration*, measures the number of years a buyer and a supplier have worked together from 2003 up to the current year. Again, the results are largely similar to my earlier analysis. Here, an additional year of working together results in it being 1.1 to 1.2 times[15] less likely that the relationship was terminated.

[15] 1/0.88 to 1/0.843

Table 1.12: Logit of Terminated on Institutions, 2003-2009 Sample

	i	*ii*	*iii*	*iv*	*v*
Contract Viability		1.465	1.505	1.507	1.590
		[2.54]**	[2.45]**	[2.48]**	[2.53]**
Relationship Duration, 2003-2009			0.843	0.844	0.880
			[2.66]***	[2.54]**	[1.91]*
Buyer Supplier Countries				0.992	1.265
				[0.14]	[6.28]***
MNC Flag					0.421
					[4.63]***
Price	0.999	0.999	0.999	0.999	1.000
	[0.29]	[0.38]	[0.32]	[0.32]	[0.16]
N	936	928	928	928	928
Pseudo R2	0.28	0.29	0.29	0.29	0.31
Log pseudolikelihood	-458	-450	-445	-445	-437

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and year fixed effects. Errors are clustered by buyer. Coefficients are reported as odds ratios. z-statistics in parentheses.

Finally, we may still be concerned that there are other unobserved factors at the country level that may be correlated with contract enforcement institutions. To investigate this I reconducted my initial analysis while including country-of-origin fixed effects and clustering the standard errors by the country of origin. I present these results in Table 1.13. These coefficients on *Contract Viability* differ substantially from my earlier analyses and appear to suggest that stronger contracting institutions decrease the likelihood that a relationship will be terminated. I attribute this to the role of the country fixed effect. Since the baseline country effect is now zeroed out in these regressions, the coefficient on *Contract Viability* is measuring the effect of a change in *Contract Viability*. Thus it is the small number of countries whose contracting institutions changed from 2008 to 2009 that are driving this result. Only eight countries in my sample had a *Contract Viability* value that changed and in all cases the value of their contract enforcement declined. The vast majority of these declines occurred in countries which already had strong institutions. The largest drops in *Contract Viability* occurred in the UK

where it fell from 3.75 to 3, Spain from 4 to 3.6, France from 3.92 to 3.5, and the US 3.9 to 3.7. Consequently these results are suggesting that a decrease in Contract Viability led to a higher likelihood that a relationship was terminated because most of the decreases in Contract Viability occurred in countries that already had high levels of contract enforcement.

Table 1.13: Logit of Terminated on Independent Variables with Country Fixed Effects and Errors Clustered by Country

	i	*ii*	*iii*	*iv*	*v*
Contract Viability		0.016	0.016	0.011	0.012
		[2.20]**	[2.17]**	[2.36]**	[2.33]**
Relationship Duration			0.681	0.693	0.714
			[2.11]**	[2.02]**	[1.87]*
Buyer Supplier Countries				0.957	0.970
				[3.09]***	[2.13]**
MNC Flag					0.821
					[2.99]***
Price	0.997	0.997	0.997	0.997	0.997
	[2.65]***	[2.70]***	[2.64]***	[2.65]***	[2.65]***
N	2,872	2,781	2,781	2,781	2,781
Pseudo R2	0.23	0.24	0.24	0.24	0.24
Log pseudolikelihood	-1480	-1423	-1420	-1419	-1417

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer, year, and country fixed effects. Errors are clustered by country. Coefficients are reported as odds ratios. z-statistics in parentheses.

1.5.4 Did Suppliers in Strong Enforcement Countries Exit?

A final concern we may have is that suppliers in countries with strong contract enforcement institutions exited their businesses during the financial crisis at a higher rate than suppliers in countries with weak contract enforcement institutions, for reasons unrelated to the fact that their relationships were more likely to be terminated with buyers that sourced internationally. If this were the case, perhaps because of an ongoing shift to source from new developing countries that are more likely to have weak contract enforcement institutions, then buyers would not be terminating relationships because of a

need to preserve relationships due to relational contracting considerations but simply because these suppliers had gone out of business. To address this concern I check which suppliers out of the ones used on terminated and non-terminated relationships were active on the platform and shipping orders to any buyer in 2010. Specifically, I divide the countries in my sample into high and low contract enforcement countries by splitting them into two groups using the median country values of Contract Viability and Property Rights.[16] I then calculate the number of relationships that were terminated in strong and weak contract enforcement countries, and determine the number of these relationships where the supplier was still active in 2010. Using these two numbers I calculate the percentage of these terminated relationships where the supplier was still active in 2010 for countries with strong and weak enforcement and conduct a means comparison between the two groups. The results are in Table 1.14.

[16] A country with a Contract Viability value above or equal to the median was given a Strong Contract Viability value of one, zero otherwise. Similarly, a country with a Property Rights value above or equal to the median was given a Strong Property Rights value of one, zero otherwise.

Table 1.14: Relationships with Suppliers Operating in 2010

Contract Viability

	Terminated Relationships	Terminated Relationships with Suppliers Operating in 2010	Ratio	Continued Relationships	Continued Relationships with Suppliers Operating in 2010	Ratio
Weak Enforcement	1023	154	15.05%	1628	1009	61.98%
Strong Enforcement	708	141	19.92%	979	581	59.35%
			t=2.65			t=1.33
			p=0.0041			p=0.0912

Property Rights

	Terminated Relationships	Terminated Relationships with Suppliers Operating in 2010	Ratio	Continued Relationships	Continued Relationships with Suppliers Operating in 2010	Ratio
Weak Enforcement	1156	187	16.18%	1856	1173	63.20%
Strong Enforcement	575	108	18.78%	751	417	55.53%
			t=1.36			t=3.646
			p=0.0873			p=0.0001

Note: t and p values are for comparisons that the larger mean is greater than the smaller mean.

The results are striking. Of the relationships that were terminated 19.9% of the relationships in countries with strong enforcement (as measured by Contract Viability) were with suppliers that still transacted on the platform in 2010. In contrast only 15.1% of relationships terminated in countries with weak enforcement were with suppliers that were still on the platform in 2010. Using a t-test, the former average was significantly above the latter, below the 1% significance level. The results are similar when categorizing countries by Property Rights, though the percentage of relationships terminated in strong countries whose suppliers still existed on the platform was 18.8%, the percentage in weak countries was 16.2%, and a t-test found that these were significantly different only at the 10% level. These results provide substantial evidence

that buyers were not terminating more relationships in countries with strong enforcement because these suppliers had exited in higher numbers than suppliers in weak enforcement countries, since it was less likely that the terminated suppliers in strong enforcement countries had exited. These results suggest that, if anything, the suppliers used in countries with strong institutions were less likely to have gone out of business than the suppliers used in countries with weak institutions, even though their relationships were terminated more frequently by these buyers.

1.6 Discussion

In this chapter I set out to examine whether there were hidden costs to using private enforcement mechanisms – specifically relational contracting – as a means of overcoming weak contract enforcement institutions, that only revealed themselves when firms had to reconfigure their international supplier networks in response to a crisis. To do this I developed a model that predicted how buyers would select which relationships to keep and which to terminate based on the supplier's local contract enforcement environment. I then used a unique set of data on international contract manufacturing purchase orders to test whether these predictions were born out. In all cases, my results confirmed my predictions. Buyers did systematically shield their relationships with suppliers in weak contract enforcement countries at the expense of suppliers in stronger enforcement countries for reasons that cannot be explained by cost, and also protected relationships that had existed for longer periods of time. These results held in the face of a host of robustness checks. These findings suggest that, in the context of global sourcing, relying on relational contracting can decrease a firm's flexibility to optimally configure its supplier networks, and weak institutions can protect local suppliers.

Several aspects of this paper provide foundations for future research. Few papers in international business use formal modeling, and this chapter demonstrates that we can gain a better understanding of rich international business phenomena by using formal models. Further this paper shows how modeling techniques used in organizational economics can be easily applied in an international business setting, due to their flexible and tractable nature. Using formal models like these to understand cross border phenomena, and global supply chains in particular, is likely to be a rich avenue of future research. There is also enormous scope for future work that investigates more thoroughly how firms use relational contracting and other private enforcement mechanisms to do business in countries with weak institutions and poor business environments. As global companies continue to do ever-more activities in countries with weak institutions the importance of understanding the benefits and limitations of using relational contracting is only likely to increase.

Sourcing from Multinational Suppliers to Overcome Weak Contracting Institutions and Gain Supply Chain Capabilities

2.1 Introduction

The way in which the boundaries of the firm respond to differences in institutions has been an active area of research in the recent international trade and international business literatures. When firms look to produce overseas they choose to produce internally (vertically integrate) instead of outsourcing to third parties in response to contracting hazards and weak institutional environments (Henisz 2000, Antras and Helpman 2004, Yeaple 2006, Feenstra and Hanson 2005). However, firms are increasingly outsourcing sections of their value chains to third parties in very weak institutional environments. Though some work exists looking at how firms use private enforcement mechanisms to substitute for weak institutions (McMillan and Woodruff 1999, Johnson, McMillan and Woodruff 2002, Lerner and Schoar 2005, Antras and Foley 2011), this work misses an increasingly important phenomenon in global outsourcing, namely, outsourcing overseas to suppliers that are themselves multinational firms.

In this chapter I postulate that using a multinational (MNC) supplier provides a buyer with several advantages relative to using a local supplier when sourcing from a given country. A MNC supplier based in a country with strong institutions could provide a bridge by which buyers could source from new, low cost, poor institution locations. In cases of contract disputes, the MNC supplier could be taken to court in its home country where legal institutions are stronger. Further, a MNC supplier may be less likely to renege on an agreement in one country if doing so will lead to a loss of business in another country. I also hypothesize that buyers may choose to use MNC suppliers because they have superior capabilities relative to local suppliers. Specifically, MNC

suppliers may be able to help buyers coordinate their multi-country multi-product sourcing, may be able to compensate for a lack of buyer experience sourcing from the particular country, and may have greater economies of scale by aggregating orders from several buyers. However, I also postulate that using MNC suppliers incurs costs relative to their local-only counterparts and thus MNC suppliers are only used when their benefits outweigh their costs.

In this chapter I investigate the degree to which MNC suppliers are used instead of local suppliers in order to overcome weak contracting institutions and to access supplier capabilities that benefit buyers with particular characteristics. Firstly, I look at whether firms are using MNC suppliers to overcome weaknesses in host country contracting institutions or other institutions. Secondly, I look at whether buyers choose MNC suppliers because they are able to provide services that help the buyer manage the breadth of products a buyer sources. Thirdly, I look at whether a buyer's experience in the sourcing country obviates its need to use MNC suppliers. Fourthly, I look at the impact the size of a buyer's supplier network has on the likelihood that an order will be given to a local or MNC supplier. Finally, I look at the impact that the total volume of a buyer's sourcing has on the choice of supplier type.

To conduct this investigation I use a unique set of international contract manufacturing orders containing the global orders of ten, US-based, buyers and their 350 suppliers in the sportswear, apparel, footwear, toy, and furniture industries. In this sample, the orders were sourced from 21 countries and were worth $1.6bn between 2007 and 2009.

I find strong evidence that both contract enforcement institutions and the characteristics of buyers that make MNC supplier capabilities particularly valuable, play a strong role in determining whether a buyer uses a MNC or local supplier. Buyers were much more likely to use MNC suppliers in weak contracting environments, when they had many different types of product to produce, when they had little experience sourcing from the given country, when they had a small supplier network, and when their total sourcing volumes were small.

The chapter is laid out as follows. In Section 2.2 I lay out the hypotheses that I will investigate. In Section 2.3 I describe the outsourcing data that this chapter uses, and describe the independent variables and controls used in my analysis. The empirical analysis is presented in Section 2.4. I look at the robustness of the choice of my institutional measures in Section 2.5. I conclude in Section 2.6.

2.2 Hypotheses

Contracting institutions have increasingly become a center of attention in the international trade and international business literatures. The strength of contract enforcement has been found to affect the decision to set up wholly owned subsidiaries or outsource to third parties (Yeaple 2006), the decision to extend credit (McMillan and Woodruff 1999, Johnson et al. 2002, Antras and Foley 2011) and firm performance (Taussig 2011). In the context of international contract manufacturing, contract enforcement has a particularly significant effect on performance because buyers typically have no ownership stake in the supplier. When contract enforcement institutions are weak, buyers can not rely on contract penalties and must instead rely on other, usually costlier

or less effective mechanisms to ensure that shipments are delivered on time, in the right quantities, made to the correct specifications, and of sufficient quality.

I postulate that one mechanism to reduce the negative effects on performance of a weak contract enforcement environment is to source from a MNC supplier instead of a local-only supplier, for several reasons. Firstly, many MNC suppliers also operate in countries with stronger contract enforcement institutions and can be prosecuted for breach of contract in these countries. The MNC supplier is effectively renting higher quality foreign institutions (Seigel 2005). Secondly, the buyer may be transacting with the MNC supplier in multiple countries and can use the threat of cancelling orders in several countries to enforce contract compliance in a weak institution country. Thirdly, a MNC supplier may be more likely to comply with a contract because the damage to its reputation may be greater because it works with a larger number of buyers, has a larger volume of orders, or has a more visible international profile. Consequently, by operating in multiple countries, a MNC supplier is undertaking Ghemawat's (2003) economic function of *arbitrage* by deriving a location specific advantage through its cross-border presence.

However, a MNC supplier is also likely to incur additional costs relative to a local supplier because it must maintain offices in other, potentially higher cost, countries, faces liabilities of foreignness that increase its costs (labor, land, permits), and the fragmentation of management attention across multiple locations. Consequently, I hypothesize that buyers will only use MNC suppliers when the benefits to using them, e.g. their ability to lessen the negative performance effects of weak institutions, outweigh their additional higher costs. Specifically, buyers are likely to use MNC suppliers more

frequently when contracting institutions for a particular country are weak and more likely to use local suppliers in countries with stronger contract enforcement institutions.

Hypothesis 1: A buyer is increasingly likely to use a MNC supplier than a local supplier the weaker the contract enforcement institutions in the given country being sourced from.

Another arbitraging advantage a MNC supplier gains through its cross border operations is the ability to gain both local knowledge as well as knowledge of working with international buyers. Through the MNC supplier's local operations it can gain a deeper knowledge of local business practices and regulations than a foreign buyer that has little experience in that country. In addition, through its overseas operations, a MNC supplier can develop a knowledge of the processes and expectations of international buyers that provide it with an advantage relative to local suppliers.[17] However, this advantage erodes if the buyer has a long experience of sourcing from the given country and has developed extensive knowledge of how to source effectively from local suppliers. Consequently, with the additional costs of using MNC suppliers, I hypothesize that buyers with longer experience sourcing from a given country are less likely to source from MNC suppliers than buyers with less experience.

Hypothesis 2: A buyer with more experience sourcing from a given country is less likely to source from a MNC supplier than a local one.

An alternative reason a buyer may choose to source from a MNC supplier is that the supplier has capabilities that are valuable to the buyer. Li & Fung, for example, has claimed that it is better able to manage the production and assembly of different

[17] The advantage also erodes as local suppliers become more sophisticated. This is likely correlated with the overall level of economic development, which I control for.

components of products than a buyer typically is on its own. Further, the company claims that, through its network of suppliers, it is better able to find the best producer across different countries for different types of products than a foreign buyer would be on its own and that, by aggregating sourcing needs across multiple buyers, they are able to get greater economies of scale in their operations (Magretta 1998). In the context of this analysis, I hypothesize that a MNC supplier has capabilities related to sourcing different types of products, sourcing products from multiple countries, and achieving economies from scale. Each of these capabilities is an example of Ghemawat's *aggregation* function as it is through their cross border operations that MNC suppliers are better able to offer multiple types of products, a wider array of manufacturing locations, and, indirectly through the resulting larger order volumes, economies of scale. However, as before, these MNC capabilities are likely to come with increased costs and they may be less relevant for certain buyers or can be substituted for with a buyer's own capabilities. A MNC supplier's ability to source multiple products is less valuable to a buyer that does not need to source many products. Similarly, a buyer that works with a larger network of suppliers has less need of a MNC supplier's capabilities in sourcing multiple products from different locations. Further, a buyer with larger sourcing volumes has less need of the economies of scale that MNC suppliers can amass through aggregating orders from multiple buyers. Consequently, I hypothesize that buyers choose MNC suppliers only when the MNC supplier's capabilities are valuable to the buyer because of that buyer's characteristics.

Hypothesis 3: A buyer that sources many different types of products is more likely to source from a MNC supplier than a local supplier.

Hypothesis 4: A buyer with a larger network of suppliers is less likely to source from a MNC supplier than a local one.

Hypothesis 5: A buyer with larger sourcing volumes is less likely to source from a MNC supplier than a local supplier.

Some of these hypotheses were validated in interviews with managers. Several managers claimed that they were starting to source from new, lower cost countries with the help of MNC suppliers who they had sourced from previously in other countries. A purchasing manager for a major footwear retailer that also sells shoes under its own labels explained that his firm particularly chose to source from its core, multinational suppliers in countries with weak business environments. Further the company particularly preferred to use these suppliers when entering countries with poor environments where it did not have prior experience because these MNC suppliers often had shorter lead times and faster effective shipping times than local suppliers. Though he denied that these suppliers received explicitly higher prices, he mentioned that the firm was trying to shift more production away from these suppliers to achieve lower prices, particularly in countries where they had established supplier networks. Other managers explained how it was particularly helpful to have suppliers that could produce different components in different locations. A purchasing manager in a large diversified capital goods company, that sourced from around the world, noted that his company particularly favored suppliers that could supply more varieties of products as this helped their ongoing efforts to rationalize their purchasing.

2.3 Data

Remarkably little quantitative research has been done on international outsourcing and little, if any, large sample research has been done on MNC suppliers, due to the lack of data. Most of the research that has been done either looks at outsourcing within a given country (for which there is little institutional variation) or looks at the activities that multinationals conduct across countries (offshoring instead of outsourcing). To look at the transactions between buyers and their suppliers across multiple countries, this investigation uses a unique dataset of confidential company data. This data comes from a provider of cloud-based software for supply chain oversight and management used by many global buyers.

The data used in this chapter includes all of the purchase orders between ten US-based companies and their 350 suppliers in the sportswear, apparel, footwear, toy, and furniture industries, shipping from 21 countries during 2007-2009. (See Table 2.1 for a breakdown of order volumes and Table 2.2 for order counts by country.) There were 99,063 purchase orders[18] in total worth $1.6bn during this period, and there were frequently hundreds of orders between a given buyer and a supplier sourced from a given country within each year. Of these purchase orders, 64% were given to MNC suppliers, and orders relating to perfume and toiletries, plastics, headgear and furniture were particularly likely to be given to MNC suppliers while orders for toys were particularly likely to be given to local suppliers. (See Table 2.3 for a breakdown of orders by tariff

[18] In this sample only orders containing Harmonized Tariff Schedule (HTS) data were used as it is plausible that buyers choose whether to use MNCs instead of local suppliers differently for different types of products. By using orders with HTS data I can include product fixed effects and measure the diversity of products that buyers source.

category.) The average purchase order for a MNC supplier was $16,049, only slightly higher than for local suppliers, $15,807.

Table 2.1: Total Value of Orders ($m) by Country

Country of Origin	Total Value of Orders ($m)	% to Local Suppliers	% to MNC Suppliers
China	813.6	31%	69%
Mexico	184.2	66%	34%
Singapore	95.3	28%	72%
Vietnam	84.1	10%	90%
Cambodia	78.6	20%	80%
Thailand	72.2	30%	70%
Malaysia	56.3	40%	60%
Philippines	45.7	4%	96%
Indonesia	35.1	54%	46%
Peru	31.9	96%	4%
Bangladesh	27.6	63%	37%
Taiwan	23.9	7%	93%
El Salvador	21.8	90%	10%
India	9.5	97%	3%
Hong Kong	8.6	2%	98%
Israel	8.3	5%	95%
Guatemala	5.1	93%	7%
United States	4.5	76%	24%
Turkey	3.0	91%	9%
United Arab Emirates	1.4	100%	0%
South Korea	0.4	4%	96%
Total	1611.1	36%	64%

Table 2.2: Count of Orders by Country

Country of Origin	Number of Orders	% to Local Suppliers	% to MNC Suppliers
China	36,364	31%	69%
Mexico	15,361	50%	50%
Malaysia	6,825	43%	57%
Vietnam	6,327	7%	93%
Singapore	5,230	32%	68%
Thailand	5,198	33%	67%
Philippines	4,123	3%	97%
Taiwan	3,580	2%	98%
Indonesia	3,500	70%	30%
Peru	3,137	96%	4%
Cambodia	2,920	11%	89%
El Salvador	2,327	92%	8%
Bangladesh	1,629	55%	45%
Israel	682	4%	96%
India	464	97%	3%
Hong Kong	397	1%	99%
United States	369	70%	30%
Guatemala	301	95%	5%
Turkey	235	86%	14%
United Arab Emirates	58	100%	0%
Korea, Rep.	36	50%	50%
Total	99,063	36%	64%

Table 2.3: MNC vs. Local Suppliers

2 Digit HTS Code	HTS Description	Count of Orders	% to Local Suppliers	% to MNC Suppliers
32	Tanning or dyeing extracts; dyes, pigments, paints, varnishes, putty and mastics	1	100%	0%
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	4112	0%	100%
39	Plastics and articles thereof	11	36.4%	63.6%
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut	1057	42.5%	57.5%
61	Articles of apparel and clothing accessories, knitted or crocheted	54,144	38.6%	61.4%
62	Articles of apparel and clothing accessories, not knitted or crocheted	18,548	27.5%	72.5%
64	Footwear, gaiters and the like; parts of such articles	19994	45.8%	54.2%
65	Headgear and parts thereof	593	13.2%	86.8%
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings	27	33.3%	66.7%
95	Toys, games and sports requisites; parts and accessories thereof	576	61.5%	38.5%
	Total	99,063	36.4%	63.6%

Out of the 350 suppliers, 232 were local while 118 suppliers were multinational. The data used for this chapter contains information on the size of the purchase order, its country of origin, the average price per unit, date ordered, date shipped, the type of product (indicated by an eight digit US Harmonized Tariff Schedule code), the location

of the supplier's office that processed the order, and the year in which the order was made. Throughout this chapter I analyze this data at the level of the purchase order.

2.3.1 Dependent Variables

The main dependent variable used in this investigation is whether or not the order was given to a MNC or local supplier. The supplier was categorized as local (*MNC* flag=0) if, on all transactions on the platform between 2007 and 2009, the supplier's office(s) was in only one country, all transactions involving that supplier were shipped from only one country, and the country the office was located in and the country goods were shipped from were the same. The supplier was categorized as being multinational (*MNC flag=1)* in all other cases. However, there is a potential bias towards categorizing a buyer as local, when it is in fact a multinational. The supplier may have offices in other countries, or ship from other countries but only serves the buyers on the platform from one country and from the office in that country. This is less of a concern for this investigation because categorizing MNC suppliers as local biases the investigation away from finding that there is a difference between the transactions allocated to local vs. MNC firms. Furthermore, from the point of view of the buyers in this sample, these suppliers are more similar in the services they provide to local suppliers.

To identify whether a supplier was chosen based on the fact that it has operations in a country with strong contract enforcement (where it could be sued for damages in case of breach of contract) I also create another dependent variable *Strong MNC*. Here, all countries in the sample were ranked based on the strength of their contract enforcement and classified as strong enforcement if they were above the median. Next, all suppliers who had operations in at least one strong enforcement country were

classified as being strong enforcement suppliers. If an order had a strong enforcement supplier it was assigned a *Strong MNC* value of one, if not, zero.[19]

2.3.2 Independent Variables

The main independent variable in this study is the strength of contract enforcement. This analysis primarily uses the *Contract Viability* variable from the International Country Risk Guide (PRS Group 2011) as its main measure of the strength of the contract enforcement institutions in the country sourced from. This measures "the risk of unilateral contract modification and, at worst, outright expropriation of foreign assets"[20] and ranges from zero to four (2.25-4 for the countries in the sample), in increments of 0.5, where four indicates the strongest enforcement of contracts. While the measure is available monthly, it is averaged by year for the purpose of this investigation. This measure of contract enforcement is used both because it is commonly used in the academic literature and is, arguably, the most granular metric available for a large sample of countries that is consistently measured over long time periods. For robustness, the analysis is replicated using the *Property Rights* measure from the Heritage Foundation (Heritage Foundation 2011). This measure ranges from 5 to 95 (10-90 for the sample) where 95 implies strong protection of property rights and quick and efficient enforcement of contracts. I compare both *Contract Viability* and *Property Rights* against a set of other institutional indices from the ICRG and the Heritage Foundation in the robustness section of this chapter.

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[19] As this dependent variable is only used in samples that only consider orders in countries with weak institutions, all suppliers with operations in strong enforcement countries were, by default, MNCs.

[20] Guide to Data Variables, the PRS Group (accessed February 2011)

To look at the second hypothesis I calculate how many years a buyer has been sourcing from a given country from 2007 up to the year in which a given order is placed (*Buyer Country Experience*). For example, an order placed in 2008 in a given country for a buyer that had also placed orders from that country in 2007 would be assigned a *Buyer Country Experience* value of 2.

To investigate the third hypothesis, I tally how many product categories a buyer sources in each year (*Buyer HTS02 Count)*. For this data, the majority of transactions have information on the type of product sourced in the form of US Harmonized Tariff Schedule (HTS) codes. The first two digits describe the main category while additional digits refine the categorization. I use a count of the two digit code instead of a count of the four, six, or eight digit code as this provides the best measure of product variety. The four, six, or eight digit code counts emphasize within category variation at the expense of cross category variation.

To measure the size of a buyer's supplier network in a given year (*Buyer Total Suppliers*), to examine hypothesis four, I count all the suppliers that shipped to a given buyer per year. Finally, for hypothesis five, I calculate every buyer's total orders in $ millions per year (*Buyer Total Orders*).

2.3.3 Controls

As controls, this investigation uses the average price per unit of the order[21] (*Price*), and the total size of the order, in thousands of dollars (*Order Size*). I also include

[21] An order's price per unit was calculated by taking the average price per unit of each sub-line item on that order and weighting it by the dollar volume of that order. Prices in currencies other than US dollars were converted using annual exchange rates from www.oanda.com

measures of GDP (*GDP*) and GDP per capita (*GDPpc*) from the World Bank's World Development Indicators (World Bank 2011) in my regressions to ensure that contracting institutions are not proxying for a country's overall level of economic development.

The descriptive statistics for these variables and controls are presented in Table 2.4, and the correlations between them are presented in Table 2.5.

Table 2.4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
MNC Flag	99,063	0.636	0.481	0	1
Contract Viability	96,143	2.96	0.563	2.25	4
Property Rights	99,063	36.81	20.73	10	90
HTS02 Count	99,063	5.83	2.22	1	12
Experience	99,063	1.96	0.79	1	3
Suppliers	99,063	31.96	14.97	5	107
Orders	99,063	0.198	0.117	0.00458	0.371
Price	99,063	11.9	12.8	0.01	267
Order Size	99,063	16263	34305	0.04	1937721
GDPpc	95,483	6675	8996	434	50070
GDP	95,483	1981	2137	8.6	14369
Ports	95,483	4.07	1.01	2.342	6.831
Wages	80,809	559	629	88	3263
Homicides	62,749	7.26	12.23	0.377	71
Repatriation	96,143	2.86	0.576	2	4
Payment Delays	96,143	2.68	0.632	2	4
Corruption	96,143	2.57	0.660	1.5	4.5
Bureaucratic Quality	96,143	2.45	0.615	2	4
Law & Order	96,143	3.78	0.979	1	5
Business Freedom	99,063	62.69	15.16	42.7	98.3
Trade Freedom	98,494	73.59	8.39	40.2	95
Investment Freedom	99,063	41.14	15.86	20	90
Financial Freedom	99,063	42.56	13.52	20	90
Freedom from Corruption	99,063	38.00	16.04	17	94

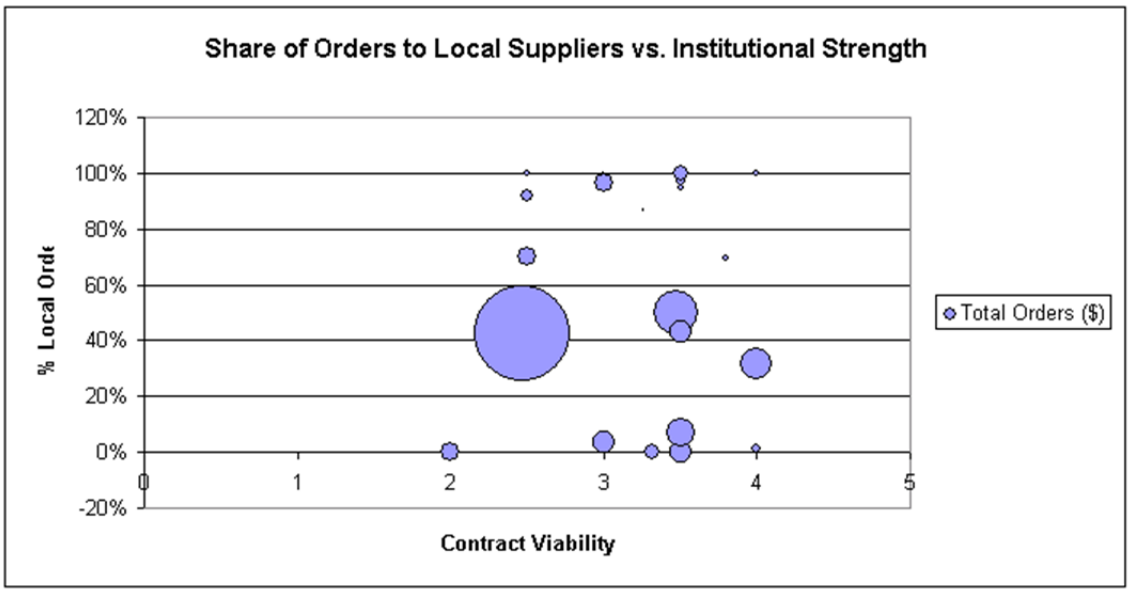
Table 2.5: Correlations

	MNC Flag	Contract Viability	Property Rights	HTS02 Count	Experience	Suppliers	Orders	Price	Order Size	GDPpc	GDP	Ports	Wages	Homicides
MNC Flag	1													
Contract Viability	-0.130	1												
Property Rights	0	0.804	1											
HTS02 Count	0	-0.153	-0.155	1										
Experience	0	-0.046	0.130	0.090	1									
Suppliers	0	0.069	0.120	0.185	0.064	1								
Orders	0	0.544	0.359	-0.156	-0.245	0.042	1							
Price	0	-0.302	-0.269	-0.076	-0.060	-0.012	-0.224	1						
Order Size	0	-0.092	-0.089	0.058	-0.083	0.017	-0.101	0.123	1					
GDPpc	0	0.728	0.884	-0.096	0.069	0.121	0.275	-0.170	-0.030	1				
GDP	0	-0.513	-0.587	0.134	-0.083	0.054	-0.378	0.272	0.116	-0.255	1			
Ports	0	0.194	0.540	0.002	0.097	0.003	-0.082	0.046	0.050	0.753	0.044	1		
Wages	0	0.633	0.812	-0.075	0.054	0.096	0.216	-0.123	-0.014	0.976	-0.177	0.791	1	
Homicides	0	0.282	0.269	-0.084	0.330	0.261	0.167	-0.241	-0.122	-0.074	-0.462	-0.468	-0.227	1

2.4 Empirical Analysis

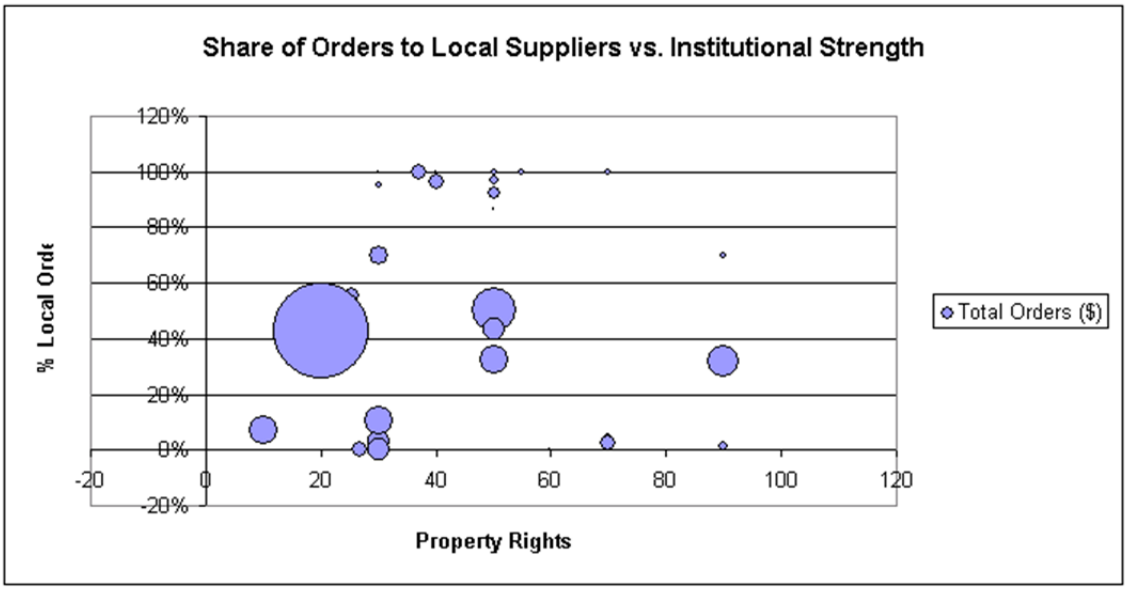
The primary goal of this investigation is to examine whether buyers choose MNC suppliers over local suppliers as a strategy to overcome weak institutions. Figure 2.1 shows the share of orders allocated to local suppliers as a percentage of all orders plotted against *Contract Viability* (where higher values indicate stronger contract enforcement). The size of each bubble indicates the total volume of orders in that country. Figure 2.2 shows a similar graph except plotted against *Property Rights* (again, higher values indicate stronger contract and property rights enforcement). In both of these graphs we can discern a pattern of orders predominantly allocated to MNC suppliers when institutions are weak and allocated to local suppliers when institutions are strong.

Figure 2.1: Share of Orders to Local Suppliers vs. Strength of Contracting Institutions (Contract Viability), 2007-2009



Note: Bubble size indicates total orders per country

Figure 2.2: Share of Orders to Local Suppliers vs. Strength of Contracting Institutions (Property Rights), 2007-2009



Note: Bubble size indicates total orders per country

2.4.1 Means Comparisons

I next conduct a series of t-tests, whose results are shown in Table 2.6. For the first t-test I divide the countries in my sample into high vs. low *Contract Viability* groups based on the median country *Contract Viability* score. I then compare the average use of a MNC supplier per order for all orders going to the two groups of countries. The results indicate that usage of MNC suppliers is higher in strong contract enforcement institutions. However, this test gives us a faulty understanding of the relationship between the choice of MNC suppliers and the local contract environment. By categorizing orders based on the median country *Contract Viability* score, few observations are allocated to the high enforcement group, and the majority of these orders are sourced from Singapore and Taiwan, which are the headquarters countries for many MNC suppliers. Consequently, it

is not that buyers are choosing MNC suppliers over local suppliers in these countries, but that local-only suppliers are relatively scarce. In my next test I divide countries by the median *Property Rights* score and allocate orders to the two groups. Here I find that the use of MNC suppliers is significantly higher amongst countries with weak contract enforcement. A large reason for this is that, using *Property Rights*, orders from Mexico are included among the strong enforcement countries, unlike when using *Contract Viability*, and Mexico is both a large source of orders and a country where local suppliers are frequently used.

Table 2.6: T-tests

T-test of MNC Flag by Hi & Lo Contract Viability

Category	N	Mean	St. Dev.
High	29559	0.691735	0.002686
Low	84719	0.554421	0.001708
Combined	114278	0.589939	0.001455
Difference		0.137314	0.130851

t=41.6
Pr(|T| > |t|) = 0.0000

T-test of MNC Flag by Hi & Lo HTS02 Count

Category	N	Mean	St. Dev.
High	98989	0.681258	0.465991
Low	18393	0.150873	0.357934
Combined	117382	0.59815	0.490274
Difference		0.530385	0.523291

t=147
Pr(|T| > |t|) = 0.0000

T-test of MNC Flag by Hi & Lo Property Rights

Category	N	Mean	St. Dev.
High	43043	0.552517	0.49724
Low	71235	0.61255	0.487171
Combined	114278	0.589939	0.491847
Difference		-0.06003	-0.06591

t=-20
Pr(|T| > |t|) = 0.0000

T-test of MNC Flag by Hi & Lo Buyer Country Experience

Category	N	Mean	St. Dev.
High	77244	0.584291	0.492847
Low	40138	0.624819	0.484176
Combined	117382	0.59815	0.490274
Difference		-0.04053	-0.04644

t=-13
Pr(|T| > |t|) = 0.0000

T-test of MNC Flag by Hi & Lo Supplier Networks

Category	N	Mean	St. Dev.
High	93794	0.674787	0.468457
Low	23588	0.293412	0.455335
Combined	117382	0.59815	0.490274
Difference		0.381375	0.374725

t=112
Pr(|T| > |t|) = 0.0000

T-test of MNC Flag by Hi & Lo Buyer Total Orders

Category	N	Mean	St. Dev.
High	93409	0.67729	0.467515
Low	23973	0.289784	0.453672
Combined	117382	0.59815	0.490274
Difference		0.387506	0.380911

t=115
Pr(|T| > |t|) = 0.0000

I also conduct a series of t-tests allocating orders according to the characteristics of the buyer, to get a first glimpse as to whether MNC or local suppliers are chosen depending on these characteristics. I first allocate orders based on the number of 2 digit HTS categories (*HTS02 Count*) the buyer orders products in. Buyers were separated into two groups based on the median number of HTS categories a buyer sourced,[22] and orders were correspondingly allocated between the two groups. Comparing the average use of

[22] The median *HTS02 Count*, like the median *Country Experience*, *Buyer Supplier Network*, and *Total Orders* were calculated based on the average of these values, per buyer across the years 2007-2009.

MNC suppliers on orders in the group with many product categories with the group with few, I see that MNC suppliers were overwhelmingly used (68% of the time vs. 15%) on orders by buyers who sourced many categories of products.

Next I divide buyers, and their corresponding orders, by the median amount of *Country Experience* and find that the average use of a MNC supplier was significantly higher in the group where *Country Experience* was low.

When I allocate orders based on the size of a buyer's supplier network (*Suppliers*) we see that the average use of an MNC supplier was significantly higher in the group with a larger supplier network than in the group with the smaller network. Finally, when I divide buyers and their orders by the median amount of *Total Orders*, I find that the average use of a MNC supplier was significantly higher when in the group where *Total Orders* was high, i.e. large buyers tend to use MNC suppliers more frequently.

2.4.2 Regressions

To conduct a much more in-depth investigation into the way in which the contracting environment and the characteristics of the buyer affect the choice of using a MNC or local supplier I conduct a series of logistic regressions using the following model.

$$MNCflag_i = f(\beta_1 Institution_{ct} + \beta_2 HTS02count_{bt} + \beta_3 Experience_{cbt} + \beta_4 Suppliers_{bt} + \beta_5 Orders_{bt} + \beta_6 GDP_{ct} + \beta_7 Price_i + \beta_8 OrderSize_i + \zeta_B + \theta_c + \eta_t + \vartheta_p + \varepsilon_i)$$

Here $MNCflag_i$ reflects whether a MNC or local supplier was used on order *i*. $Institution_{ct}$ measures the contract enforcement in country *c* in year *t*. $HTS02count_{bt}$ is a count of the number of product categories (as defined by the 2 digit HTS codes) the

buyer *b* sourced in year *t*. $Experience_{cbt}$ measures the number of years since 2007 the buyer *b* has sourced from country *c* by year *t*. $Suppliers_{bt}$ measures the number of suppliers *b* sources from in year *t*. $Orders_{bt}$ is the total dollar volume of orders *b* sourced in year *t*. GDP_{ct} measures either GDP or GDP per capita in country *c* at *t*. $Price_i$ and $OrderSize_i$ are controls for the price per unit and total dollar value of the order *i*. ζ_B, θ_c, η_t, and ϑ_p are sets of dummy variables corresponding to buyer, country, year, and product category fixed effects. ε_i is the error term.

I begin by regressing *MNC Flag* on *Contract Viability* and *Property Rights* to see whether a buyer was more likely to give an order to a local or a MNC supplier subject to the institutional environment. The results of these regressions are in regressions (ii) in Table 2.7 and in Table 2.8. These regressions include controls for *Price* and *Order Size*, and also include buyer, year, country of origin, and product (at the 4 digit HTS code level) fixed effects. Standard errors are clustered at the product level and all coefficient estimates are presented as odds ratios. I find that a MNC supplier is less likely to be chosen when contracting institutions are strong (high values of *Contract Viability* or *Property Rights*). A one point increase in *Contract Viability* (stronger institutions) make it 2.3 times[23] less likely that a MNC supplier was chosen. A one point increase in *Property Rights* (stronger institutions) make it 1.6 times less likely that a MNC supplier was chosen. Interestingly, neither *Price* nor *Order Size* have any explanatory power in the choice of whether a MNC or local supplier was used.

[23] 1/0.427

Table 2.7: Logit of MNC Flag on Contract Viability and Capabilities

	i	*ii*	*iii*	*vi*	*v*	*vi*
Contract Viability		0.427	0.425	0.434	0.392	0.563
		[2.90]***	[2.94]***	[2.82]***	[3.16]***	[2.79]***
HTS02 Count			1.147	1.146	1.199	1.15
			[2.65]***	[2.60]***	[3.84]***	[2.52]**
Country Experience				0.426	0.331	0.312
				[1.95]*	[2.51]**	[2.61]***
Total Suppliers					0.977	0.983
					[4.18]***	[2.08]**
Total Orders						0.996
						[1.59]
Price	0.998	0.999	0.999	0.998	0.997	0.997
	[0.17]	[0.10]	[0.15]	[0.22]	[0.34]	[0.30]
Order Size	1	1	1	1	1.001	1.001
	[0.17]	[0.31]	[0.31]	[0.30]	[0.33]	[0.40]
N	99,063	95,916	95,916	95,916	95,916	95,916
R2	0.43	0.43	0.43	0.43	0.44	0.44
Log pseudolikelihood	-36,866	-35,830	-35,772	-35,740	-35,572	-35,526

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects. Errors are clustered by Product. z-statistics in parentheses.

Table 2.8: Logit of MNC Flag on Property Rights and Capabilities

	i	*ii*	*iii*	*iv*	*v*	*vi*
Property Rights		0.624	0.655	0.708	0.728	0.715
		[3.61]***	[3.32]***	[2.82]***	[2.56]**	[2.55]**
HTS02 Count			1.178	1.18	1.226	1.172
			[3.25]***	[3.21]***	[4.48]***	[2.38]**
Country Experience				0.394	0.308	0.305
				[2.18]**	[2.75]***	[2.69]***
Total Suppliers					0.98	0.986
					[3.02]***	[1.59]
Total Orders						0.994
						[2.34]**
Price	0.998	0.999	0.998	0.997	0.996	0.997
	[0.17]	[0.16]	[0.24]	[0.31]	[0.43]	[0.33]
Order Size	1	1	1	1	1	1
	[0.17]	[0.16]	[0.19]	[0.19]	[0.23]	[0.29]
N	99,063	99,063	99,063	99,063	99,063	99,063
R2	0.43	0.43	0.43	0.43	0.44	0.44
Log pseudolikelihood	-36,866	-36,849	-36,759	-36,723	-36,589	-36,420

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects. Errors are clustered by Product. z-statistics in parentheses.

The second goal of the analysis is to investigate whether buyers choose MNC suppliers because of the capabilities of the supplier, i.e. the buyer has characteristics that make the supplier's capabilities particularly attractive. The capabilities I am focusing on are the ability to supply multiple types of products, the knowledge of operating in a country that comes with experience operating in that country, having access to a large supplier network, and the ability to get economies of scale. In regressions (iii) in Tables 2.7 and 2.8 we see that buyers are more likely to choose a MNC supplier when the buyer sources many different types of products (high *Buyer HTS02 Count*). Every additional 2 digit HTS category that a buyer sources makes it 1.1 and 1.2 times respectively more likely that the buyer will choose a MNC supplier. I interpret this to suggest that buyers who need to source multiple products value MNC suppliers because MNC suppliers on average can supply a greater variety of products.[24]

In regressions (iv) in both tables we find that buyers are less likely to use a MNC supplier when the buyer has more prior experience sourcing from the country. With each additional year the buyer is 2.3 and 2.5 times,[25] respectively, more likely to source from a local supplier.

Buyers are also less likely to use MNC suppliers when they have a large supplier network (high *Buyer Total Suppliers*). In regressions (v) we see that for every 10

[24] In this sample, the average local only supplier supplied orders in 1.26 2-digit HTS categories. The average MNC supplier supplied 1.6 categories. A t-test of these means found them to be significantly different (t=-5.14)

[25] 1/0.426 and 1/0.394

additional supplier's in a buyer's sourcing network the buyer is 1.2 times[26] less likely to source from a MNC supplier.

The effect when a buyer has larger total sourcing (high *Buyer Total Orders*), is less clear. In regression (vi) in Table 2.7, the coefficient is insignificant. However, the coefficient in the same regression in Table 2.8 is significant and implies that a buyer is 1.01 times[27] less likely to source from a MNC supplier for every additional million dollars worth of sourcing it does that year.

Noticeably, the coefficient estimates on all of these variables remain roughly on the same order of magnitude throughout these regressions. A one point improvement in contracting institutions as measured by *Contract Viability*, leads to a between 1.8 and 2.6 times lower likelihood of choosing a MNC supplier. Sourcing an additional product category (one point increase in *Buyer HTS02 Count*) makes it roughly 20% more likely that a MNC supplier will be chosen in all of the regressions. An extra year's worth of experience sourcing from a given country make it between 2.3 and 3.3 times less likely that a MNC supplier will be chosen. Having an additional ten suppliers in one's supplier network (*Buyer Total Suppliers* higher by ten) decreases the likelihood of choosing a MNC supplier by 15-26%.

2.4.3 Renting Stronger Contracting Institutions

To further investigate whether MNC suppliers are able to rent the stronger contract enforcement institutions of other countries they operate in, I next conduct regressions using the *Strong MNC* dependent variable. This variable measures whether a

[26] (1/0.98)^10

[27] 1/0.994

supplier operates in at least one above median contract enforcement country.[28] Here I limit the sample to countries with weak contract enforcement institutions as measured either by below median country *Contract Viability* and *Property Rights* respectively, and I regress the level of *Contract Viability* and *Property Rights* on whether a *Strong MNC* supplier was used or not.[29] The results, presented in Table 2.9 show that, a MNC with operations in a strong enforcement country is much more likely to be chosen in countries with worse contract enforcement institutions. In the sample created using the *Contract Viability* threshold, a one point increase in *Contract Viability* made it 2.4 times[30] less likely that a MNC with operations in a strong country would be used. In the Low *Property Rights* sample a one point increase in *Property Rights* made it 1.2 times[31] less likely that a strong country MNC would be used.[32]

[28] The Strong MNC variable is calculated separately for each sample based on whether *Contract Viability* or *Property Rights* was being evaluated

[29] I exclude countries with above median institutions because all suppliers operating in these countries are categorized as strong country suppliers by the definition of this variable.

[30] 1/0.414

[31] 1/0.819

[32] Note: country fixed effects are not included in these regressions because, with the smaller sample of orders and countries there is insufficient variation in contract enforcement institutions within each country over this time period.

Table 2.9: Logit of Strong MNC on Contract Viability, Property Rights in Weak Institution Countries

	Low Contract Viability Countries	*Low Property Rights Countries*
Contract Viability	0.414	
	[2.41]**	
Property Rights		0.819
		[6.11]***
Price	1.002	0.994
	[0.16]	[0.78]
Order Size	1.003	1.002
	[2.17]**	[2.37]**
N	55,103	41,491
R2	0.24	0.4
Log pseudolikelihood	-23,554.44	-14,926.05

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, and Product fixed effects.

Errors are clustered by Product. z-statistics in parentheses.

2.5 Robustness

A particular concern when examining the importance of national institutions is that the institution under examination is correlated with various other factors, e.g. level of development or culture, that in turn affect the dependent variable. By including country level fixed effects, much of this is controlled for as my results are driven by the change in country institutions over the time period. However, we still have the problem that country institutions tend to change simultaneously and are thus correlated. It could be that buyers are choosing whether to use MNC or local suppliers based on other institutions that happen to be changing at the same time as the contracting institutions. To make sure my contracting institutions are not merely proxying for a country's level of development I rerun my full model in Table 2.7 and Table 2.8 including GDP and GDP per capita. The

results are in Table 2.10. Except for the coefficient on *Buyer Total Orders*, which now becomes significant to the 5% level in regressions including *Contract Viability* and *GDPpc*, neither significance, direction or magnitude are substantially changed.

Table 2.10: Logit of MNC Flag on Contracting Institutions, Capabilities, and GDP

	i	*ii*	*iii*	*iv*
Contract Viability	0.610	0.382		
	[2.50]**	[4.30]***		
Property Rights			0.738	0.730
			[2.43]**	[2.36]**
HTS02 Count	1.169	1.238	1.214	1.215
	[2.36]**	[3.07]***	[2.39]**	[2.91]***
Country Experience	0.342	0.252	0.366	0.259
	[2.26]**	[2.87]***	[2.19]**	[2.79]***
Total Suppliers	0.979	0.978	0.978	0.985
	[3.04]***	[2.17]**	[2.92]***	[1.62]
Total Orders	0.997	0.994	0.998	0.992
	[1.11]	[2.38]**	[0.87]	[2.75]***
GDP	0.9997		0.9994	
	[0.77]		[1.45]	
GDPpc		1.00038		1.00024
		[2.18]**		[1.51]
Price	0.996	0.997	0.996	0.996
	[0.40]	[0.37]	[0.47]	[0.40]
Order Size	1.00072	1.00073	1.00043	1.00045
	[0.45]	[0.45]	[0.35]	[0.37]
N	92,336	92,336	95,483	95,483
R2	0.43	0.43	0.43	0.43
Log pseudolikelihood	-35,253	-35,118	-36,096	-36,093

*** p<0.1; ** p<0.05; *** p<0.01**
Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects.
Errors are clustered by Product. z-statistics in parentheses.
Coefficients are reported as odds ratios.

To ensure that contracting institutions are the most relevant institutions for understanding whether a MNC or local supplier is chosen I conduct a series of regressions using *Contract Viability*, *Property Rights*, and other relevant institutional indices from the ICRG and the Heritage Foundation. From the ICRG I selected *Repatriation* (the extent to which "profits can be transferred out of the host country"[33]),

[33] The PRS Group, "Guide to Data Variables" (accessed February 2011)

Payment Delays ("factors affecting the timeliness or delays in payments to those exporting to the country" [34]), *Corruption* ("A measure of corruption within the political system that is a threat to foreign investment" [35]), *Bureaucratic Quality* (the "institutional strength and quality of the bureaucracy" [36]), and *Law & Order* (the "strength and impartiality of the legal system", and the "popular observance of the law" [37]). From the Heritage Foundation indices, I chose *Business Freedom* (a "measure of the ability to start, operate, and close a business"[38]), *Trade Freedom* (a "measure of the absence of tariff and non-tariff barriers"[39]), *Investment Freedom* ("a variety of restrictions typically imposed on investment"[40]), *Financial Freedom* ("a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector"[41]), and *Freedom from Corruption* ("a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government"[42]). Almost all of these variables are highly correlated (see Table 2.11 for correlations) and thus I orthogonalize them for use in this investigation. The results of regressing *MNC Flag* on the orthogonalized ICRG variables are presented in Table 2.12, while the results

[34] Ibid.

[35] Ibid.

[36] Ibid.

[37] Ibid.

[38] http://www.heritage.org/index/business-freedom (accessed 4/18/2012)

[39] http://www.heritage.org/index/trade-freedom (accessed 4/18/2012)

[40] http://www.heritage.org/index/investment-freedom (accessed 4/18/2012)

[41] http://www.heritage.org/index/financial-freedom (accessed 4/18/2012)

[42] http://www.heritage.org/index/freedom-from-corruption (accessed 4/18/2012)

of regressing *MNC Flag* on the orthogonalized Heritage Foundation indices are presented in Table 2.13. In the first table we see that *Contract Viability, Repatriation, Payment Delays,* and *Burequcratic Quality* are all significant and imply that stronger institutions make it less likely that a MNC supplier will be chosen for a given order. However, the coefficient on *Contract Viability* is much smaller than any of the other variables, implying that contracting institutions are particularly relevant to the choice of supplier type. In the second of these tables we see that, out of the selected Heritage Foundation indices, only *Property Rights* is significant. I interpret these results as evidence that contracting institutions are particularly important when buyers choose which MNCs they source from.

Table 2.11: Correlations Between Institutional Indices and GDP

	Contract Viability	Property Rights	Payment Delays	Corrup-tion	Bureau. Quality	Law & Order	GDP	GDPpc
Contract Viability	1							
Property Rights	0.629	1						
Payment Delays	0.752	0.714	1					
Corruption	0.383	0.387	0.427	1				
Bureaucratic Quality	0.786	0.804	0.843	0.337	1			
Law & Order	-0.054	-0.114	-0.298	0.407	-0.052	1		
GDP	-0.549	-0.305	-0.672	-0.149	-0.414	0.582	1	
GDPpc	0.616	0.748	0.683	0.612	0.808	0.260	-0.167	1

	Property Rights	Business Freedom	Trade Freedom	Invest. Freedom	Financial Freedom	Corrup-tion	GDP	GPDpc
Property Rights	1							
Business Freedom	0.867	1.000						
Trade Freedom	0.752	0.653	1					
Investment Freedom	0.849	0.730	0.654	1				
Financial Freedom	0.726	0.679	0.600	0.742	1			
Corruption	0.798	0.660	0.665	0.721	0.257	1		
GDP	-0.469	-0.480	-0.185	-0.412	-0.544	-0.134	1	
GPDpc	0.836	0.744	0.682	0.793	0.394	0.926	-0.149	1

Table 2.12: Logit of MNC Flag on Orthogonalized Institutions, ICRG

	i	*ii*	*iii*
Contract Viability	0.000282	0.000632	0.00125
	[8.33]***	[2.53]**	[5.67]***
Repatriation	0.0277	0.0346	0.0324
	[9.98]***	[2.24]**	[8.52]***
Payment Delays	0.0260	0.0226	0.0291
	[3.88]***	[2.31]**	[3.22]***
Corruption	1.46	1.97	2.03
	[0.84]	[1.19]	[1.40]
Bureaucratic Quality	0.000402	0.00109	0.00148
	[6.89]***	[1.89]*	[7.74]***
Law & Order	2.23	1.98	1.42
	[2.78]***	[2.72]***	[0.94]
GDPpc		0.856	
		[0.22]	
GDP			0.474
			[1.94]*
Price	1.000	0.999	0.999
	[0.03]	[0.10]	[0.14]
Order Size	1	1	1.000001
	[0.27]	[0.31]	[0.33]
N	95,916	92,336	92,336
R2	0.44	0.42	0.42
Log pseudolikelihood	-35705	-35446	-35376

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects. Errors are clustered by Product. z-statistics in parentheses.

Table 2.13: Logit of MNC Flag on Orthogonalized Institutions, Heritage Foundation

	i	*ii*	*iii*
Property Rights	0.000024	0.000009	0.000044
	[7.43]***	[2.78]***	[6.19]***
Business Freedom	0.646	0.653	1.101
	[1.14]	[1.08]	[0.15]
Trade Freedom	1.447	1.401	1.526
	[0.78]	[0.77]	[0.82]
Investment Freedom	1.133	1.046	1.531
	[0.23]	[0.09]	[0.51]
Financial Freedom	2.347	2.131	2.659
	[2.45]**	[1.06]	[2.67]***
Freedom from Corruption	0.432	0.458	0.496
	[2.40]**	[2.18]**	[2.23]**
GDPpc		1	
		[0.33]	
GDP			0.486
			[0.71]
Price	0.999	0.998	0.998
	[0.16]	[0.23]	[0.26]
Order Size	1	1	1
	[0.12]	[0.16]	[0.20]
N	98494	94914	94914
R2	0.43	0.42	0.42
Log pseudolikelihood	-36509	-36247	-36226

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects. Errors are clustered by Product. z-statistics in parentheses.

It is also possible that MNC suppliers are being chosen for other potential reasons that happen to be correlated with the contracting environment. Buyers may, for example, be preferring to use MNC suppliers in countries with particularly weak infrastructure, or where crime is particularly high. They may even be choosing to use MNC suppliers in countries with particularly low wages to avoid accusations of exploitive labor practices. To examine the importance of physical infrastructure on the choice of supplier type I include data on the quality of port infrastructure (*Ports*) from the World Development Indicators (World Bank 2011). This metric was chosen because it is both highly relevant to the kinds of transactions in my data, and because it is the most complete series

measuring infrastructure, in terms of countries and my time frame, available. To proxy for crime I use the number of homicides per 100,000 population (*Homicide*) from the UN Office on Drugs and Crime (UNODC 2011), and to account for wages I use nominal average wages from the International Labour Organization's Key Indicators of the Labour Market (ILO 2011). The results of this analysis are presented in Table 2.14 and Table 2.15 and include *Contract Viability* and *Property Rights* respectively. In regression (ii) in both tables we see that port infrastructure is highly significant and implies that buyers are much more likely to source from MNC suppliers in countries where port infrastructure is weak. In regressions (iii) and (iv) in both tables we see that neither wages nor the homicide rate are statistically significant. The results concerning contracting institutions and the number of different types of products a buyer sources stay consistent with the previous regressions while the results regarding a buyer's experience sourcing from the country in question, the buyer's total number of suppliers and total orders fluctuate substantially with the inclusion of either *Wages* or *Homicide*. I attribute part of this to the smaller sample for which data is available.

Table 2.14: Logit of MNC Flag on Contract Viability, Capabilities, and Additional Variables

	i	*ii*	*iii*	*iv*
Contract Viability	0.563	0.256	0.427	0.163
	[2.79]***	[3.38]***	[1.86]*	[2.66]***
HTS02 Count	1.150	1.502	1.137	1.170
	[2.52]**	[5.02]***	[2.00]**	[2.36]**
Country Experience	0.312	0.209	0.851	22.173
	[2.61]***	[3.41]***	[0.23]	[2.06]**
Total Suppliers	0.983	0.966	0.977	1.032
	[2.08]**	[3.43]***	[1.74]*	[1.57]
Total Orders	0.996	1.000	0.997	1.001
	[1.59]	[0.01]	[1.01]	[0.17]
Ports		0.049		
		[4.70]***		
Wages			1.001	
			[0.45]	
Homicides				0.923
				[0.93]
Price	0.997	0.997	0.993	0.986
	[0.30]	[0.32]	[0.93]	[1.63]
Order Size	1.001	1.001	1.000	0.999
	[0.40]	[0.44]	[0.32]	[0.61]
N	95,916	92,336	80,660	61,422
R2	0.44	0.43	0.39	0.41
Log pseudolikelihood	-35526	-34816	-32305	-23103

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects.
Errors are clustered by Product. z-statistics in parentheses.

Table 2.15: Logit of MNC Flag on Property Rights, Capabilities, and Additional Variables

	i	*ii*	*iii*	*iv*
Property Rights	0.715	0.691	0.984	0.737
	[2.55]**	[2.93]***	[0.25]	[2.94]***
HTS02 Count	1.172	1.355	1.077	1.075
	[2.38]**	[5.23]***	[1.41]	[1.29]
Country Experience	0.305	0.213	0.790	31.553
	[2.69]***	[3.51]***	[0.34]	[2.20]**
Total Suppliers	0.986	0.979	0.985	1.050
	[1.59]	[2.44]**	[1.36]	[2.52]**
Total Orders	0.994	0.994	0.994	0.997
	[2.34]**	[2.07]**	[1.85]*	[0.67]
Ports		0.101		
		[4.50]***		
Wages			0.999	
			[0.41]	
Homicides				1.059
				[0.77]
Price	0.997	0.997	0.993	0.985
	[0.33]	[0.36]	[0.91]	[1.71]*
Order Size	1.000	1.001	1.001	0.999
	[0.29]	[0.45]	[0.35]	[0.52]
N	99,063	95,483	80,660	61,422
R2	0.44	0.43	0.39	0.41
Log pseudolikelihood	-36420	-35814	-32359	-23242

*** p<0.1; ** p<0.05; *** p<0.01**
Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects.
Errors are clustered by Product. z-statistics in parentheses.

An additional concern is that, since the capabilities related variables are strongly linked to the buyer, standard errors should be clustered at the level of the buyer. To address this I rerun my regressions including the buyer related variables and clustering at the level of the buyer. The results, presented in Table 2.16, show that while significance is reduced for some variables (*Buyer HTS02 Count* is now significant only at the 15% level in both regressions), for the most part the results remain the same in terms of significance, magnitude, and direction.

Table 2.16: Logit of MNC on Capabilities, Errors Clustered by Buyer

	i
HTS02 Count	1.219
	[1.52]
Country Experience	0.246
	[1.68]*
Total Suppliers	0.985
	[2.44]**
Total Orders	0.992
	[2.22]**
GDPpc	1
	[0.97]
Price	0.996
	[0.38]
Order Size	1
	[0.35]
N	95483
R2	0.43
Log pseudolikelihood	-36,100

*** p<0.1; ** p<0.05; *** p<0.01**
Note: Regressions include Buyer, Year, Country of Origin, and Product fixed effects.
Errors are clustered by Buyer. z-statistics in parentheses.

Finally, we may be worried that buyers are predominantly choosing whether to use MNC or local suppliers based on how far the host country is from the buyer's headquarters (located in the US for the vast majority of buyers in my sample) and that some of these variables may be correlated with this distance. To account for the importance of distance, I include data from the CEPII (Mayer and Zignago 2011) on distance in thousands of miles between the host country and the US in Tables 2.17 and 2.18. However, as the distance between countries does not change from year to year, I cannot include country fixed effects in these regressions.

Table 2.17: Logit of MNC Flag on Contract Viability and Distance to the US

	i	*ii*	*iii*	*vi*	*v*	*vi*
Contract Viability		0.625	0.626	0.673	0.673	0.700
		[2.46]**	[2.45]**	[2.09]**	[2.08]**	[1.87]*
HTS02 Count			1.039	1.078	1.097	1.061
			[0.85]	[1.70]*	[2.01]**	[1.18]
Country Experience				5.726	5.626	5.775
				[8.41]***	[9.09]***	[9.35]***
Total Suppliers					0.991	0.996
					[2.21]**	[0.74]
Total Orders						0.997
						[1.81]*
Distance to US	1.081	1.079	1.079	1.080	1.079	1.077
	[2.72]***	[2.56]**	[2.56]**	[2.47]**	[2.45]**	[2.32]**
Price	1.025	1.026	1.026	1.034	1.034	1.035
	[0.87]	[0.88]	[0.88]	[1.02]	[1.01]	[1.02]
Order Size	1.0011	1.0014	1.0014	1.0016	1.0017	1.0018
	[0.79]	[0.89]	[0.90]	[0.92]	[0.95]	[0.98]
N	108,487	105,156	105,156	105,156	105,156	105,156
R2	0.21	0.21	0.21	0.24	0.24	0.24
Log pseudolikelihood	-56,103	-54,371	-54,365	-52,584	-52,539	-52,481

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, and Product fixed effects.

Errors are clustered by Product. z-statistics in parentheses.

Coefficients are reported as odds ratios.

Table 2.18: Logit of MNC Flag on Property Rights and Distance to the US

	i	*ii*	*iii*	*iv*	*v*	*vi*
Property Rights		0.962	0.962	0.964	0.964	0.964
		[4.74]***	[4.77]***	[4.37]***	[4.33]***	[4.28]***
HTS02 Count			1.098	1.129	1.140	1.106
			[1.69]*	[2.25]**	[2.38]**	[1.58]
Country Experience				5.507	5.479	5.665
				[13.62]***	[14.00]***	[14.91]***
Total Suppliers					0.995	1.000
					[1.23]	[0.08]
Total Orders						0.997
						[1.75]*
Distance to US	1.081	1.112	1.113	1.113	1.113	1.111
	[2.72]***	[3.51]***	[3.51]***	[3.23]***	[3.22]***	[3.09]***
Price	1.025	1.023	1.023	1.031	1.031	1.032
	[0.87]	[0.78]	[0.78]	[0.89]	[0.88]	[0.89]
Order Size	1.0011	1.0017	1.0017	1.0017	1.0017	1.0018
	[0.79]	[1.06]	[1.09]	[1.03]	[1.04]	[1.07]
N	108,487	108,347	108,347	108,347	108,347	108,347
R2	0.21	0.25	0.25	0.28	0.28	0.28
Log pseudolikelihood	-56,103	-52,838	-52,801	-51,262	-51,247	-51,173

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Year, and Product fixed effects.
Errors are clustered by Product. z-statistics in parentheses.
Coefficients are reported as odds ratios.

In all of these regressions we see that distance to the US is a highly significant predictor of whether a MNC supplier is used. An additional one thousand mile distance from the US corresponds to it being 1.08 to 1.11 times more likely that a MNC supplier was used. However, the vast majority of the other variables remain similar in terms of significance and direction, though the magnitude of most are reduced and the significance of some are lessened. In regressions ii to vi in Table 2.17 we see that Contract Viability falls from being significant at the 1% level to being, in most cases significant at the 5% level. Also, whereas previously a one point increase in Contract Viability made it 2.3 times less likely that a MNC supplier was chosen, in Table 2.17 the regressions suggest that a one point increase makes it 1.4 to 1.6 times less likely. In Table 2.18 we see that Property Rights remains significant at the 1% level, but its magnitude is decreased. Now

a ten point increase in Property Rights corresponds to it being 1.5 times less likely that a MNC supplier is chosen. In the case of HTS02 Count, significance is reduced from the 1% level to 5% and 10% level and it loses significance entirely in regressions vi in both Tables 2.17 and 2.18. Also its magnitude is reduced. The same is true of Total Suppliers. Total Orders remains the same in terms of significance and magnitude. The largest surprise in these regressions is the coefficient on Country Experience. The direction of this variable flips and becomes significant at the 1% level in all cases. This coefficient now implies that every additional year's worth of experience that the buyer has sourcing from the local country makes it 5.5-5.7 times more likely that a MNC supplier is chosen. This result is driven by the removal of country fixed effects because the orders in my sample are concentrated in countries where buyers heavily source from MNC suppliers and have been sourcing from these suppliers for a longer period of time.

2.6 Conclusion

In this chapter I set out to examine whether buyers are using MNC suppliers as a means of overcoming weak contracting institutions or whether they are using MNC suppliers for their capabilities in coordinating production, their knowledge of the host country business environment, their ability to manage supplier networks, or for gaining economies of scale. My analysis suggests they are doing all of the above. I find that buyers are much more likely to choose MNC suppliers in countries with weak institution or poor infrastructure, and are more likely to use MNC suppliers when they need to source many different types of products, have little host country experience, have small supplier networks, and have small total ordering volumes.

This research would be enhanced with more granular data on MNC supplier activities and capabilities, and many more investigations of MNC supplier activities are possible using the data in this paper. It would be interesting to extend the time horizon of this data which would allow us to investigate how suppliers expand their operations from one country to the next. Alternatively, one could augment the data with information on local competitive environments, supplier operations, and capabilities, to better understand their areas of competitive advantage, or gather more data on buyer activities to understand how and when MNC suppliers take over these activities. It would be equally fascinating to look beyond the industries in this dataset to more capital or research intensive industries to see how MNC suppliers use their reach to tap into resources and capabilities abroad. MNC suppliers are an increasingly visible component of international trade and their importance is only likely to continue to grow as firms in developed countries outsource ever more activities.

The Effect of Credit Markets, Financial Institutions, and Market Power on Trade Credit Terms in International Contract Manufacturing During the Financial Crisis

3.1 Introduction

Trade credit is increasingly being recognized as an important determinant of trade. Studies have found that trade credit made up 15% of non-farm, non-financial liabilities in the US (Elliehausen and Wolken 1993) and 15-30% of firm assets in the G7 countries (Rajan and Zingales 1995). Trade credit has been found to be the single most important source of short-term external finance for US firms (Petersen and Rajan 1997), accounted for 2.5 times the value of all new public debt and equity issues in the US during the 1990s (Ng, Smith and Smith 1999), and was the most important source of financial intermediation for small and medium-sized enterprises, particularly in countries with weak financial institutions (Fabbri and Klapper 2008). The importance of trade credit for international trade is large enough that the dramatic drop in international trade following the financial crisis is often attributed to the precipitous decline in the provision of trade credit (Auboin 2009, IMF 2009, Ahn 2010).

Despite the importance of trade credit, remarkably little is certain about the determinants of trade credit. Scholars have posited three major categories of factors that affect a supplier's willingness to extend trade credit: i) the supplier's access to credit and local financial institutions and capital markets (Petersen and Rajan 1997, Burkart and Ellingsen 2004, Cunat 2007), ii) the buyer's creditworthiness (Ng, Smith and Smith 1999, McMillan and Woodruff 1999, Johnson et al. 2002, Antras and Foley 2011), and iii) market power between the buyer and the supplier (Wilner 2000, Fabbri and Klapper 2008, Giannetti et al. 2011). However, the evidence put forward to verify the importance of

these determinants has been lacking due to the paucity of trade credit data. Most papers on trade credit have relied on cross sectional data on firm accounts payable and receivable in the National Survey of Small Businesses Finances (NSSBF), or have used surveys conducted in individual emerging or transition countries. Almost none of these have been able to study transaction level data, any cross border trade, or how trade credit changes over time. A notable exception to this is Antras and Foley (2011), which demonstrated the importance of buyer credit worthiness and relational contracting (category ii) in determining the provision of trade credit, using transactions of a supplier and its buyers across 140 countries.

This study complements Antras and Foley (2011) by analyzing the role of local supplier financial institutions and credit markets, and market power considerations on the provision of trade credit. I am able to conduct this analysis thanks to a unique dataset of international contract manufacturing purchase orders worth $13.8bn from 22 large predominantly US based buyers and their 1203 suppliers across 47 countries from 2007 to 2009. To my knowledge this is the most extensive, detailed data on trade credit that has been analyzed and the first time trade credit data from multiple buyers and sellers, and across multiple countries and years, has been available for analysis. A particularly helpful, unique feature of this data is the information on every order's payment tenor – the number of days between delivery of goods and payment – that provides an unusually nuanced measure of the degree of trade credit between parties.[43]

Using this data, I find that local credit markets and buyer market power, as measured by the size of the buyer's local supplier network, significantly influence the

[43] Prior studies have focused on whether trade credit was provided or whether discounts were offered for early payment – which typically vary very little by buyer

length of trade credit terms (payment tenor) a supplier is willing to extend to a buyer. I also use the financial crisis as a quasi-natural experiment to show that payment tenor increased in response to the financial crisis. The change in payment tenor as a response to the financial crisis is economically substantial implying an increase in payment tenor equivalent to a 7% increase in interest free lending from suppliers to buyers. However, suppliers in countries with shallow credit markets increased their trade credit terms less than suppliers in countries with stronger institutions and deeper credit markets. Similarly, buyers with larger local supplier networks prior to the crisis were able to extend their payment tenors more than buyers with smaller local networks. However, market power, as measured by a buyer's total sourcing volumes was not significant in all of my analyses. My results on financial institutions are less clear, countries with strong credit registry coverage did have longer payment tenors and countries with weak credit bureau coverage did extend tenors less as a response to the crisis. However, countries with weak financial institutions as measured by the Heritage Foundation's Financial Freedom index increased their payment terms substantially.

This chapter is divided into seven sections. In Section 3.2 I review the literature on trade credit, institutions, and market power and derive my hypotheses. I describe my data in Section 3.3 and my methodology in Section 3.4. I present the results of my analysis in Section 3.5. In Section 3.6 I conduct an extensive array of robustness checks. Finally, in Section 3.7, I discuss the results, their contributions and limitations, and directions for future research.

3.2 Theoretical Development

The literature on trade credit comes out of a broader literature in international trade and international finance that has long noted the importance of credit markets and financial institutions for international trade. Kletzer and Bardhan (1987) noted that differences in credit contract enforcement led to differences in comparative advantage in industries that required working capital and trade finance between countries. Beck (2002) found that financial development increased exports by facilitating large-scale high-return projects, while Chor and Manova (2009) found that countries with higher inter-bank rates exported less to the US. Paravisini et al. (2011) found that, at the firm level, access to credit affected exports, using bank credit data from Peru. This literature has unambiguously demonstrated the importance of financial markets and institutions for international trade, but it has not been able to determine whether this impact is because financial markets affect a supplier's ability to invest or provide trade credit.

The recent attention on trade credit during the last two decades can be traced to the availability of data on accounts payable and receivable available for a large sample of small US firms through the National Survey of Small Business Finances (NSSBR) and a host of studies that demonstrated the large economic significance of trade credit (Elliehausen and Wolken 1993, Rajan and Zingales 1995, Petersen and Rajan 1997, and Giannetti et al. 2011). The literature on trade credit can be broadly categorized as investigating the determinants of the provision of trade credit according to three main themes, i) the supplier's local financial institutions and credit markets, ii) the buyer's creditworthiness and the methods of enforcing payment, and iii) market power between the buyer and supplier.

3.2.1 Supplier Financial Institutions and Credit Markets

Perersen and Rajan (1997), a founding study in the literature on trade credit, found that trade credit was used more frequently when credit from financial institutions was unavailable, but that, at the same time, firms with better access to credit offered more credit. Several models were later developed to explain why trade credit existed in the presence of banks and other specialized financial intermediaries. Burkart and Ellingsen (2004) created a model that, based on the notion that it is easier and more profitable to misappropriate cash than inputs, found that suppliers have an advantage over traditional financial institutions in providing buyers with credit, particularly in countries with weak credit markets. Cunat (2007) added to the notion that suppliers have an advantage in offering trade credit over banks, by being able to threaten to stop the supply of intermediate goods to the buyer in the future.

3.2.2 Buyer Creditworthiness and Collecting Payment

In contrast to this work which has emphasized credit availability as a determinant of the provision of trade credit, another stream of work looked at how trade credit was offered based on the buyer's creditworthiness, product quality issues, and the supplier's ability to use the courts to extract payment. Ng, Smith and Smith (1999) used US firm survey data to analyze the determinants of trade credit and found that terms varied according to issues of buyer creditworthiness (buyers with a good reputation got better terms) and product quality (established suppliers offered worse terms) and did not vary in response to market demand fluctuations. McMillan and Woodruff (1999) investigated the use of trade credit in Vietnam and found that it varied in response to the supplier's ability

to gather information about the buyer and his ability to apply community sanctions to prevent buyers from defaulting.

Papers in this vein have extended this analysis to look at the effect of contract enforcement institutions in determining firms' willingness to extend credit. Johnson et al. (2002), surveyed firms in transition countries about the provision of trade credit and found that trade credit was more likely to be extended in countries with better courts, when the parties had a pre-existing relationship and when the supplier could obtain information about the buyer. Antras and Foley (2011) extended this work both theoretically – deriving predictions about the provision of trade credit from international trade models – and methodologically – using trade credit information from a large US supplier and its buyers in 140 countries. The paper found that buyers in weak contract enforcement institution countries and buyers who the supplier had not worked with previously were more frequently required to pay in advance for orders instead of being given trade credit. Further, during the financial crisis, the supplier was more likely to require cash in advance when working with new buyers.

3.2.3 Market Power

Another vein of this literature is the idea that buyers with market power can extract more trade credit from suppliers. This was first articulated in Wilner (2000) whose model found that a buyer could extract more concessions when renegotiating payment terms with a highly dependent supplier than with a less dependent one. Giannetti et al. (2011) looked at market power in the context of the NSSBF and found that larger firms in more concentrated industries received more credit, with longer payment tenors, and larger early payment discounts. Fabbri and Klapper (2008) looked at data from a

survey of 2500 Chinese SMEs and found that suppliers with less market power, as measured by whether they were the largest supplier to that buyer, were more likely to extend credit. They also found that neither access to bank funding, nor profitability determined whether a supplier was more likely to provide trade credit. Both papers found that trade credit was relatively cheap. In the Chinese context, trade credit was cheaper than bank loans in 10% of cases and in the US a majority of US firms received cheap trade credit.

By looking at this literature we see that, while many factors that affect the provision of trade credit have been proposed, there are many areas that remain poorly understood or have not been adequately investigated, largely because of the limitations of the data that has been available. A particularly large gap in this literature is our understanding of the provision of trade credit in the context of international trade. While Antras and Foley (2011), demonstrated that issues of buyer creditworthiness and local contract enforcement do affect the provision of credit in the context of cross-border transactions, none of the studies that look at the role of financial institutions nor market power look at cross-border trade. All of the studies that have looked at access to credit markets were limited to examining each country individually and thus we do not know how important variations in credit markets and financial institutions are for cross border trade credit. Given the important role that trade credit is widely believed to have in international trade, these are particularly interesting areas which I will investigate in this chapter.

Another problem with most of these investigations is that they use cross sectional data and thus there are susceptible to a host of issues related to omitted variable bias,

endogeneity and reverse causality. Firms that have better access to credit may also have many other common characteristics that may explain their willingness to extend credit.[44] Suppliers in different countries may have common national characteristics that may happen to be correlated with the institution being measured.[45] In the case of market power, it is particularly likely that firm size and industry concentration will be correlated with performance measures, such as productivity, and thus the relationship between market power and trade credit may be spurious.

Consequently, in this chapter I will try and address these gaps in the literature by using a unique set of international contract manufacturing purchase orders that track all of the purchases of 22 large, predominantly US buyers and their suppliers around the globe covering the period just before and after the recent financial crisis. In particular, I will be investigating i) the role that credit markets and financial institutions played in enabling suppliers to offer longer trade credit terms, ii) the role that market power played in allowing buyers to extract longer credit terms, and iii) how payment tenor changed in response to the financial crisis and the degree to which this can be explained by market power, financial institutions, and local credit markets. This data is uniquely well suited for this investigation because there is significant variation in credit markets and financial institutions and because it captures the entire supplier networks of these buyers allowing me to control for time-invariant characteristics of the buyer, supplier, and the country.

[44] For example, firms that offer more trade credit could perform better and thus be better able to access credit.

[45] For example, the strength of many institutions is correlated with overall economic development.

3.2.4 Hypotheses

As noted earlier, many papers in the international trade literature have found that stronger financial markets and institutions affect trade by increasing exports. One mechanism through which this occurs is that financial markets and institutions provide funding for investment. However, credit markets and financial institutions can also greatly assist in the provision of trade credit. Providing trade credit is effectively an unsecured, interest free loan from the supplier to the buyer for the payment tenor, i.e. duration between delivery of the goods and payment, and suppliers can support themselves in the intervening period using retained earnings or by accessing external financing. In countries with deeper credit markets, capital is more likely to be cheaply available. Countries with financial institutions that provide credit information (credit registries or bureaus) are also likely to offer cheaper external financing by reducing the credit risk to the lender. Similarly, countries with financial institutions that protect creditors are likely to offer cheaper external financing. Consequently, we would expect that suppliers in countries with deeper credit markets and stronger financial institutions would be better able to offer trade credit, and would offer longer payment tenors than suppliers in countries with thin credit markets and weak financial institutions.

Hypothesis 1: Suppliers in countries with deep credit markets and strong financial institutions are more likely to have longer payment tenors on their orders.

The literature on trade credit has also given us clear expectations about the role of market power in determining trade credit and the length of payment tenor. Fabbri and Klapper (2008) and Giannetti et al. (2011) found that larger buyers with more suppliers used trade credit more intensively than buyers that did not. Thus, in my data I expect that larger buyers will be able to negotiate longer payment tenor. Similarly, buyers with larger

networks of suppliers are expected to extract longer payment tenors because they are able to shift orders to their suppliers that agree to longer payment tenors from suppliers that do not.

Hypothesis 2: Larger buyers, and buyers with more suppliers, will on average negotiate longer payment tenors than smaller buyers or buyers with smaller supplier networks.

The financial crisis dramatically reduced demand in many industries, reducing order volumes and the need to source from as many suppliers. In my sample orders fell from 366,805 purchase orders before the crisis, worth $8.7bn to 294,140 orders, worth $5.1bn, after the crisis had begun. With the decrease in demand, buyers would have had stronger market power over their suppliers for several reasons. Firstly, overall demand would have been reduced so suppliers would have fewer alternative buyers. Secondly, in many cases buyers would have needed fewer suppliers given the lack of demand. Buyers could thus make credible threats to only source from suppliers who offered longer terms. Thirdly, buyers would have had a larger number of suppliers to choose from as other buyers stopped sourcing from their suppliers. We would thus hypothesize that payment tenor increased following the financial crisis as almost all buyers experienced an increase in market power.

Hypothesis 3: Average payment tenors increased following the financial crisis as a result of the general increase in buyer market power.

We might further hypothesize that buyers who had more suppliers and larger orders prior to the crisis would be particularly able to exert power over suppliers once the crisis started, relative to buyers with smaller total orders and smaller supplier networks.

Hypothesis 4: Buyers with larger orders and supplier networks prior to the financial crisis were able to extend the payment tenor on their orders longer than buyers with fewer orders and fewer suppliers.

However, the credit markets and financial institutions would have strongly affected the ability of suppliers to extend payment tenors to meet the demands of these buyers. On average we would expect supplier cash reserves to have been lessened or depleted during the financial crisis as orders fell and fixed costs were spread over fewer orders. Thus we would expect that external financing became very important during the financial crisis in order for suppliers to lengthen payment tenors. However, suppliers in countries with weak financial institutions and underdeveloped credit markets would have been at a significant disadvantage relative to suppliers in countries with developed markets that could provide financing, and at cheaper rates. Also, weak financial institutions, such as institutions that provide information about creditworthiness, would have made it difficult, or impossible, to access international financial markets, particularly for small suppliers. Consequently, we would expect that suppliers in countries with weak financial institutions and shallow local credit markets would be less able to lengthen their trade credit terms.

Hypothesis 5: Suppliers in countries with deep credit markets and strong financial institutions on average lengthened payment tenor on their orders more than suppliers in countries with shallow markets and weak institutions.

3.3 Data

International contracting manufacturing is an excellent context to study trade credit because a buyer usually sources from a network of suppliers and repeatedly

sources from each supplier. Further, this network often spans multiple countries with substantial variation in the institutional environment in each. Unfortunately, collecting this data is difficult because, in most cases, companies fiercely guard the identities of their suppliers as well as information about order volumes, prices, and trade credit terms, as this information would be very valuable to their competitors. The difficulties of collecting this data are multiplied with each additional company.

To overcome these difficulties I worked with a provider of cloud-based software that manages and provides financing services for contract manufacturing purchase orders for many large global buyers. The buyers typically manage all of their sourcing via this software, and all information about their purchase orders, from ordering through shipment, and then invoicing and payment is transmitted and processed by the software. The data is exceptional in the level of detail it provides on orders that span multiple buyers with multiple suppliers across multiple countries. The purchase orders used in this investigation contained data on the buyer, supplier, country of origin (i.e. country in which the goods were last processed), price per unit, date the order was generated and latest shipping date, payment tenor, and customs classification. Unfortunately, many buyers using the software do not record the country of origin (i.e. the last country in which the good was substantially processed before being delivered to the buyer) of the goods on their purchase orders, and thus these buyers can not be included in my study as I can not identify the relevant institutions. Further, four buyers did not record the payment tenor on their orders when the orders were generated and thus their orders were dropped from my sample.

For this investigation I analyzed all of the orders between 22 large, predominantly US-based buyers and their 1203 suppliers across 47 countries. The buyers operate in a range of industries and own some of the most famous global brands in their fields.[46] There were 633,184 orders, worth $13.6 billion, between these buyers and their suppliers between 2007-2009 and this sample represents all, or nearly all, of the orders by these buyers worldwide. Almost all of the buyers have no manufacturing of their own and fully outsource production. The buyers were substantially affected by the financial crisis with orders dropping from $8.6bn before September 15th, 2008, when Lehman Brothers filed for bankruptcy to $5bn afterwards.

I combined this data on contract manufacturing orders with information on credit market depth and financial institutions from the World Bank's World Development Indicators (World Bank 2011) and the Heritage Foundation (Heritage Foundation 2011).

3.3.1 Dependent Variable

Payment Tenor: Each order in the sample contained information on when payment was to be made by the buyer to the seller in the form of the number of days between a specified event and when the supplier would be paid. These events were typically an incoterm, e.g. Free On Board (i.e. from the date the goods are delivered to the port of shipment) or the presentation of shipping documents. In a minority of cases the event was the authorization of payment or the presentation of the invoice. Almost all buyers designated only one type of event in all of their orders. The variable *Payment Tenor* captures the number of days, on each order, between the event and when the

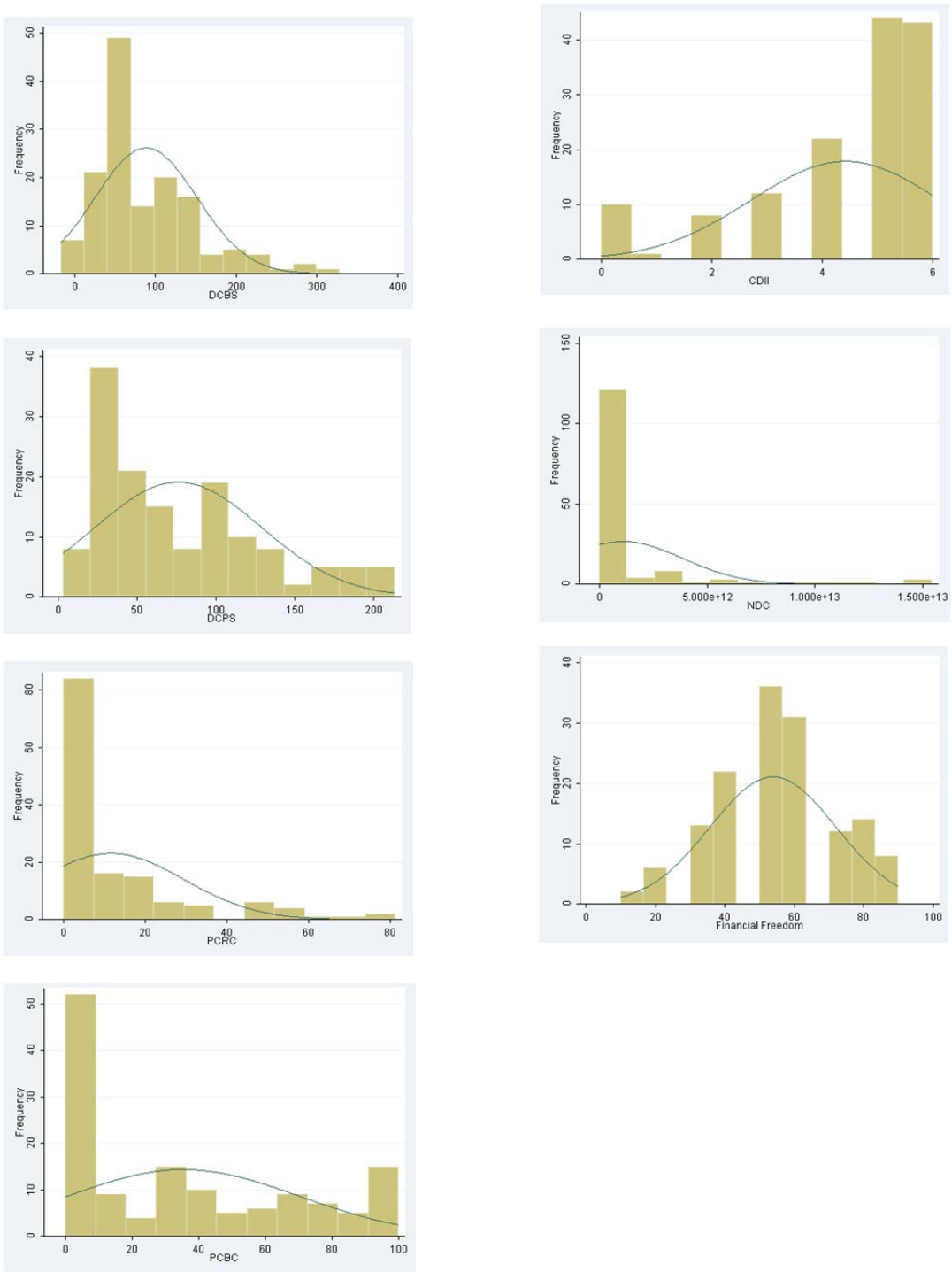
[46] The names of the buyers are not disclosed as part of the confidentiality agreement with the cloud-based software company, and every attempt has been made to disguise their identity.

supplier was to be paid. In my sample, *Payment Tenor* varied from 0 days, i.e. payment on delivery, to 120 days, and was, on average 32 days.

3.3.2 Independent Variables

DCBS: This variable is the domestic credit provided by the banking sector (DCBS), as a share of GDP, in the country where the goods were originally shipped from. Countries where a lot of domestic credit is provided by the banking sector typically have deeper credit markets than countries where a smaller amount of domestic credit is provided by the banking sector. (See Figure 3.1 for the distribution of DCBS and other credit market and financial institution metrics by country in this sample.)

Figure 3.1: Distribution of Countries by Institution



Note: Observations are at the level of country-year, 147 observations in total. The median value of DCBS is 68.4, DCPS is 60.4, PCRC is 1.3, PCBC 28.4, CDII is 5, NDC is $101bn, and Financial Freedom is 50.

Low DCBS: I ranked the 47 countries in this sample by their average DCBS value across years. All countries below the median were assigned a Low DCBS value of one. Countries at or above the median were given a Low DCBS value of zero.

DCPS: I also try to measure the depth of domestic credit markets by looking at the amount of domestic credit going to the private sector (DCPS), as a share of GDP, in the country where the goods were originally shipped from. DCPS "refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable".[47] I use DCPS as an alternative measure of the depth of the local financial markets because, in countries with low DCPS, credit is not flowing to private sector firms.

Low DCPS: As with *Low DCBS*, the 47 countries were ranked by their average DCPS value across years, and countries below the median were assigned a Low DCPS of one, while countries at or above the median were assigned a Low DCPS of zero.

NDC: The final way I measure the depth of local credit markets is to look at the country's net domestic credit. This variable measures the "the sum of net credit to the nonfinancial public sector, credit to the private sector, and other accounts".[48] I convert this variable, originally in local currency units into US dollars using yearly exchange rates from www.oanda.com.

Low NDC: Like all of the variables in this study with the prefix "Low", this variable ranks countries by the average value of variable in question, Net Domestic

[47] http://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS (accessed3/30/2012)

[48] http://data.worldbank.org/indicator/FM.AST.DOMS.CN

Credit, across years and assigns each order a one if the order came from a country that had a value less than the median country and zero otherwise.

PCRC: This variable seeks to measure the availability of credit information in a given country and is based on public credit registry coverage (PCRC) as a share of adults. PCRC "reports the number of individuals and firms listed in a public credit registry with current information on repayment history, unpaid debts, or credit outstanding."[49] A downside of using PCRC is that many developed countries do not have public credit registries. However, these countries account for a small fraction of orders.

Low PCRC: I ranked each country by PCRC and countries with values below the median were assigned a Low PCRC of one, and countries at or above the median were assigned a Low PCRC of zero.

PCBC: An alternative method of estimating the degree of credit information available is to look at private credit bureau coverage. This variable measures "the number of individuals or firms listed by a private credit bureau with current information on repayment history, unpaid debts, or credit outstanding" as a percentage of all adults. The disadvantage of using this variable is that private credit bureaus do not operate in many emerging markets.[50]

Low PCBC: Indicates whether an order was sourced from a country whose PCBC was less than that of the median country.

CDII: A final way in which I look at the financial institutions related to credit information is by using the World Development Indicator's Credit Information index.

[49] http://data.worldbank.org/indicator/IC.CRD.PUBL.ZS (accessed3/30/2012)

[50] http://data.worldbank.org/indicator/IC.CRD.PRVT.ZS

This index measures the "the scope, accessibility, and quality of credit information available through public or private credit registries".[51]

Low CDII: Indicates whether an order was sourced from a country whose *CDII* was less than that of the median country.

Financial Freedom: As a final method to measure the strength of financial institutions in a country I also include the Heritage Foundation's index of Financial Freedom. This index broadly measures "government regulation of financial services", "state intervention in banks", "financial and capital market development", "government influence over the allocation of credit", and "openness to foreign competition". In my sample the index varies from 20, "The central bank is not independent, and its supervision of financial institutions is repressive" to 90, "regulation of financial institutions is minimal but may extend beyond enforcing contractual obligations and preventing fraud."[52]

Low Financial Freedom: Indicates whether an order was sourced from a country whose Financial Freedom value was less than that of the median country.

Post Lehman: This variable indicates whether a purchase order was generated before or after the start of the financial crisis. If the order was generated on or before September 15th, 2008, the date on which Lehman Brothers filed for bankruptcy, Post Lehman was set to zero. If the order was generated after September 15th, 2008, this variable was set to one. In this sample, 349,583 purchase orders were generated prior to Lehman's collapse and 283,601 (45%) orders after.

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[51] http://data.worldbank.org/indicator/IC.CRD.INFO.XQ

[52] http://www.heritage.org/index/financial-freedom

Suppliers: This variable attempts to capture a buyer's power over local supplier by measuring the number of suppliers a buyer sources from in a particular country in a given year. When interacted with *Post Lehman* I use the total number of suppliers a buyer had in a given country in the period before the financial crisis.

Orders: This is my second measure that attempts to capture market power. *Orders* measures the total volume of orders, in millions of US dollars, a buyer sources from all of its suppliers in a given year. When interacted with *Post Lehman*, I still use the buyer's total volume of orders in the current year (as opposed to in the period before Lehman's financial crisis) to avoid collinearity with buyer or buyer*supplier*country fixed effects.

3.3.3 Controls

Order Size: This variable is the total dollar value, in thousands, of the given purchase order. Orders in currencies other than U.S. dollars were converted using annual average exchange rates.[53]

GDPpc: GDP per capita, in current U.S. dollars from the World Development Indicators.

3.4 Empirical Model

My empirical analysis is conducted in two parts. In the first part I estimate the effect of financial markets, institutions, and market power on payment tenor length. In the second part I look at how the change in payment tenor days during the financial crisis was moderated by credit markets, institutions, and market power.

[53] From www.oanda.com

In the first part I use linear regression to examine whether credit markets, institutions and market power had an affect on an order's payment tenor. I use linear regression because interpreting the resulting coefficients is straightforward and better tools are available for clustering errors at multiple levels. However there is a risk that the coefficients are biased given the discrete nature of my dependent variable. I thus also conduct these regressions using a negative binomial regression model (see Section 3.6.1). The first model I estimate is:

$$Payment\ Tenor_i = \beta_1 Institution_{ct} + \beta_2 Suppliers_{bct} + \beta_3 Orders_{bt} + \beta_4 OrderSize_i + \beta_5 GDPpc_{ct} + \zeta_b + \eta_t + \vartheta_c + \varepsilon_i$$

Here, $Payment\ Tenor_i$ is the number of days between delivery of the goods and the date the supplier will be paid[54] stipulated on each purchase order *i*. $Institution_{ct}$ measures the strength of financial markets or institutions in country *c* in year *t*. $Suppliers_{bct}$ counts the number of suppliers that buyer *b* sources from in country *c* in year *t*. $Orders_{bt}$ measures the value of all orders by buyer *b* in year *t*. $OrderSize_i$ is the dollar value of the purchase order *i* and is a control together with $GDPpc_{ct}$, which reflects the GDP per capita in the original shipping country *c* in year *t*. ζ_b, η_y, and ϑ_c are sets of dummy variables corresponding to buyer firm, year, and country fixed effects. ε_i is the error term. Table 3.1 shows the descriptive statistics for the variables used for these regressions, while Table 3.2 shows the correlations between them.

[54] More accurately, between the payment event and the time at which the supplier is paid.

Table 3.1: Part 1 Variables, Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Payment Tenor (Days)	635,740	32.3	20.8	0	120
DCBS	635,740	97.5	42.8	-16.5	328
DCPS	635,740	83.8	39.8	6.5	213
PCRC	634,934	30.7	25.3	0	81.3
PCBC	600,942	12.7	25.0	0	100
CDII	634,934	4.2	1.2	0	6
NDC	635,740	2.6E+12	3.0E+12	-3.5E+09	1.5E+13
Financial Freedom	635,200	38.4	12.8	20	90
Suppliers	635,740	24.3	27.7	1	116
Orders	635,740	1,250	1,212	0.07942	3,066
GDPpc ($)	635,740	5,048	7,396	434	57,490
Order Size ($thousands)	635,740	21.4	123	0.00001	13,533

Table 3.2: Part 1 Correlations

	Pay. Tenor	DCBS	DCPS	PCRC	PCBC	CDII	NDC	Fin. Free.	Supplier Orders	GDPpc	Order Size
Payment Tenor	1										
DCBS	-0.012	1									
DCPS	-0.027	0.970	1								
PCRC	-0.005	0.668	0.638	1							
PCBC	0.051	-0.124	-0.113	-0.412	1						
CDII	0.084	0.117	0.063	0.029	0.597	1					
NDC	0.028	0.759	0.700	0.832	-0.268	0.030	1				
Financial Freedom	0.035	-0.348	-0.302	-0.573	0.767	0.312	-0.397	1			
Suppliers	-0.117	0.522	0.516	0.631	-0.370	-0.060	0.614	-0.453	1		
Orders	-0.344	-0.154	-0.143	-0.142	-0.031	-0.119	-0.148	-0.025	0.009	1	
GDPpc	0.026	0.196	0.249	-0.215	0.674	0.293	0.053	0.623	-0.166	-0.003	1
Order Size	-0.042	0.026	0.027	0.016	-0.025	-0.011	0.010	-0.031	0.019	0.056	-0.011	1

In the second part I examine whether firms negotiated different payment tenors as a response to the financial crisis, and the role that local financial institutions, credit markets, and market power had on the changes to payment tenor. To do this I used linear regression to examine the impact of whether an order was placed before or after the crisis, and whether the order was placed in a country with weak credit markets or financial institutions, or with buyers who had market power, on the length of the payment tenor (in days) for that order. (See Section 3.6.1 for an estimation using a negative binomial regression model.) The model I estimate in this stage is thus:

$$Payment\ Tenor_i = \beta_1 Post\ Lehman_i + \beta_2 Post * Group_i + \beta_3 Post * Suppliers_i + \beta_4 Post * Orders_i + \beta_5 OrderSize_i + \beta_6 GDPpc_{ct} + \zeta_{bsc} + \varepsilon_i$$

Again, $Payment\ Tenor_i$ is the number of days between delivery of the goods and the date the supplier was paid. $Post\ Lehman_i$ is a dummy variable that indicates whether the order was placed after September 15th, 2008. $Post * Group_i$ indicates whether the order was placed after the crisis and in a country which had weak financial institutions or markets. $Post * Suppliers_i$ indicates how many suppliers a buyer had in country *c* prior to Lehman's bankruptcy, if the order *i* took place after the bankruptcy. Similarly, $Post * Orders_i$ indicates the size of a buyer's total sourcing across all countries prior to the crisis, if order *i* was issued after Lehman's bankruptcy. $OrderSize_i$ is the dollar value of the purchase order *i* and is a control together with $GDPpc_{ct}$, which reflects the GDP per capita in the original shipping country *c* in year *t*. ζ_{bsc} is a dummy variable corresponding to a fixed effect for each buyer-supplier-country triad. ε_i is the error term. Note that $Group_i$ is not included in this model because it is perfectly collinear with the

fixed effects. To see the effect of $Group_i$ directly, I reconduct this analysis without country fixed effects in Section 3.6.4. Table 3.3 shows the descriptive statistics for the variables used for these regressions, while Table 3.4 shows the correlations between them.

Table 3.3: Part 2 Variables, Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Payment Tenor (Days)	633,184	32.3	20.8	0	120
Post Lehman	633,184	0.448	0.497	0	1
Post*Low DCBS	633,184	0.154	0.361	0	1
Post*Low DCPS	633,184	0.151	0.358	0	1
Post*Low PCRC	633,184	0.123	0.328	0	1
Post*Low PCBC	633,184	0.351	0.477	0	1
Post*Low CDII	633,184	0.356	0.479	0	1
Post*Low NDC	633,184	0.144	0.351	0	1
Post*Low Financial Freedom	633,184	0.344	0.475	0	1
Post*Suppliers	625,446	9.20	16.26	0	61
Post*Orders	633,184	402	766	0	3,066
GDPpc	633,184	5,046	7,377	434	57,490
Order Size ($thousands)	633,184	21.4	123.3	0.00001	13,533

Table 3.4: Part 2 Correlations

	Pay. Tenor	Post Lehman	Post* Low DCBS	Post* Low DCPS	Post* Low PCRC	Post* Low PCBC	Post* Low CDII	Post* Low NDC	Post* Low Fin. Free.	Post* Suppliers	Post* Orders	GDPpc	Order Size
Payment Tenor	1												
Post Lehman	0.035	1											
Post*Low DCBS	0.038	0.470	1										
Post*Low DCPS	0.033	0.465	0.982	1									
Post*Low PCRC	0.056	0.407	0.664	0.643	1								
Post*Low PCBC	0.024	0.821	0.286	0.297	0.227	1							
Post*Low CDII	0.028	0.828	0.302	0.296	0.249	0.989	1						
Post*Low NDC	-0.043	0.448	0.484	0.495	0.423	0.422	0.420	1					
Post*Low Financial Freedom	0.026	0.819	0.150	0.162	0.048	0.874	0.872	0.264	1				
Post*Suppliers	-0.022	0.637	-0.105	-0.103	-0.092	0.716	0.710	0.064	0.729	1			
Post*Orders	-0.140	0.591	0.288	0.295	0.225	0.476	0.478	0.331	0.494	0.461	1		
GDPpc	0.020	-0.030	-0.051	-0.093	0.140	-0.230	-0.195	-0.168	-0.182	-0.105	-0.017	1	
Order Size	-0.040	-0.027	-0.026	-0.025	-0.023	-0.015	-0.016	-0.006	-0.017	-0.002	0.002	-0.012	1

3.5 Results

In the first part of my analysis I investigate the overall relationship between credit markets, financial institutions, and market power on payment tenor – the duration that trade credit is provided by the supplier to the buyer. I present the results of this analysis in Tables 3.5a, 3.5b, and 3.5c. Table 3.5a displays the results of the regressions that just measured credit markets and financial institutions, while Tables 3.5b and 3.5c include my two variables (*Suppliers* and *Orders*) that try to capture market power. All of these regressions include buyer, supplier, and country fixed effects and errors are clustered by buyer and country.

Table 3.5a: OLS of Payment Tenor on Institutions

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
DCBS	0.119						
	[4.40]***						
DCPS		0.131					
		[31.72]***					
PCRC			0.0069				
			[0.10]				
PCBC				-0.095			
				[2.25]**			
CDII					0.992		
					[1.22]		
NDC						0	
						[0.24]	
Financial Freedom							-0.094
							[1.19]
GDPpc	0.00062	0.00037	0.00083	0.00074	0.00094	0.00087	0.00089
	[2.40]**	[1.09]	[1.78]*	[2.41]**	[2.66]***	[1.62]	[3.01]***
Order Size	-0.00035	-0.00034	-0.00040	-0.00048	-0.00040	-0.00040	-0.00039
	[1.84]*	[1.66]*	[2.09]**	[4.26]***	[2.28]**	[2.31]**	[2.25]**
N	635,737	635,737	634,946	600,954	634,946	635,737	635,212
R2	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Log pseudolikelihood	-2,065,438	-2,065,711	-2,066,320	-1,961,448	-2,065,792	-2,068,795	-2,066,927

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.5b: OLS of Payment Tenor on Institutions and Market Power (Suppliers)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Suppliers	-0.0269	-0.0312	-0.0212	-0.0293	-0.0188	-0.0224	-0.0214
	[1.85]*	[2.20]**	[1.33]	[2.12]**	[1.15]	[1.27]	[1.34]
DCBS	0.126						
	[4.20]***						
DCPS		0.147					
		[6.76]***					
PCRC			0.027				
			[0.40]				
PCBC				-0.098			
				[2.20]**			
CDII					0.914		
					[1.15]		
NDC						0	
						[0.52]	
Financial Freedom							-0.109
							[1.43]
GDPpc	0.00073	0.00046	0.00088	0.00087	0.00102	0.00086	0.00099
	[2.53]**	[1.42]	[1.80]*	[2.28]**	[2.50]**	[1.61]	[2.88]***
Order Size	-0.00035	-0.00034	-0.00039	-0.00049	-0.00040	-0.00039	-0.00039
	[1.82]*	[1.64]	[2.07]**	[3.97]***	[2.21]**	[2.26]**	[2.19]**
N	635,737	635,737	634,946	600,954	634,946	635,737	635,212
R2	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Log pseudolikelihood	-2,064,551	-2,064,542	-2,065,784	-1,960,435	-2,065,363	-2,068,232	-2,066,372

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.5c: OLS of Payment Terms on Institutions and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Orders	-0.0011	-0.0011	-0.0012	-0.0009	-0.0011	-0.0012	-0.0012
	[1.35]	[1.37]	[1.41]	[0.91]	[1.34]	[1.37]	[1.39]
DCBS	0.117						
	[4.28]***						
DCPS		0.129					
		[14.16]***					
PCRC			0.00040				
			[0.01]				
PCBC				-0.101			
				[2.22]**			
CDII					0.908		
					[1.12]		
NDC						0	
						[0.08]	
Financial Freedom							-0.093
							[1.21]
GDPpc	0.00069	0.00045	0.00091	0.00076	0.00100	0.00090	0.00095
	[2.70]***	[1.40]	[1.98]**	[2.48]**	[2.83]***	[1.77]*	[3.20]***
Order Size	-0.00034	-0.00033	-0.00038	-0.00046	-0.00039	-0.00038	-0.00038
	[1.86]*	[1.73]*	[2.09]**	[4.91]***	[2.24]**	[2.46]**	[2.23]**
N	635,737	635,737	634,946	600,954	634,946	635,737	635,212
R2	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Log pseudolikelihood	-2,064,558	-2,064,819	-2,065,329	-1,960,936	-2,064,885	-2,067,804	-2,065,936

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

In Table 3.5a we see that domestic credit supplied by the banking sector (DCBS, regression i) and domestic credit supplied to the private sector (DCPS, regression ii) and private credit bureau coverage (PCBC, iv) have a statistically significant relationship with the payment tenor of a given order. Thicker credit markets were correlated with longer payment tenor, while better credit bureau coverage was correlated with shorter payment tenor. An increase in domestic credit provided by the banking sector of 10% of GDP corresponded to a 1.2 day increase in payment tenor, while an increase in credit provided to the private sector by 10% of GDP corresponded to a 1.3 day increase in tenor. In contrast, payment tenors in countries with an additional 10% of adults covered by credit bureaus were 0.95 days shorter. We also see that the country's level of development and the size of the order affect an order's payment tenor. A country with a GDP per capita that is higher by $1000 was expected to have average payment tenors that were between 0.6 (regression i) to 0.9 (regression v and vii) days longer. An order that was one million dollars larger was paid for roughly 0.4 days more quickly. This is an intuitive result because larger orders impose larger working capital requirements on suppliers and hence providing trade credit is more costly for these orders.

All of these results are similar in direction, magnitude, and statistical significance in Tables 3.5b and 3.5c as well. In these regressions, thicker domestic credit and a higher level of economic development is correlated with longer payment tenors while stronger credit bureau coverage and order size are correlated with faster payment terms. In Table 3.5b we also see that the number of suppliers a buyer has is correlated with an order's payment tenor. In regressions i, ii, and iv we see that a buyer with an additional ten buyers will on average have a payment tenor that is 0.3 days faster. At first glance this

result would seem to contradict hypothesis 4. However, one explanation of this phenomenon is the presence of buyer fixed effects and the fact that this period covers the financial crisis. With buyer fixed effects the coefficient on *Suppliers* is capturing changes in the number of suppliers a buyer sources from in a given country. The coefficient implies that when a buyer decreased the number of suppliers that he sourced from in a given country by 10, his average payment tenor on orders from the country increased by 0.2 days. If we expect that a buyer that sheds many suppliers in a given country has stronger market power with the remaining suppliers, then these coefficients are consistent with hypothesis 4. In contrast, in the regressions in Table 3.5c we see that a buyer's total volume of orders does not have a statistically significant relationship with payment tenor as none of the coefficients on *Orders* is significant.

In the first part of my analysis I thus find evidence that credit markets, financial institutions, and market power (as measured by a buyer's supplier network in a given country) impact the length of trade credit terms on orders. However, not all measures of credit markets were significant (the level of net domestic credit was not), nor were most of the measures of financial institutions. Notably, neither the measure of credit registries, credit information depth, nor the Heritage Foundation's Financial Freedom index had any significant relationship with an order's payment tenor. Interestingly, credit markets and financial institutions had an opposite effect on the length of credit extended, with financial institutions operating in the opposite direction that I hypothesized. With interpretation, market power, as measured by changes in a buyer's supplier network acts as hypothesized, but, surprisingly, we do not see any effect of a buyer's sourcing volume size.

3.5.1 The Financial Crisis, Institutions and Market Power

The second part of my investigation looks at how the payment tenor on orders changed as a result of the financial crisis and how this was moderated by the effects of credit markets, financial institutions, and market power. The results of this part of my investigation are presented in Tables 3.6a, 3.6b, and 3.6c. In Table 3.6a I just look at the effect of the crisis and the moderating impact of credit markets and financial institutions on payment tenor, while in Tables 3.6b and 3.6c I also include the effects of a buyer's supplier network and total sourcing. All of these regressions include a fixed effect for every buyer-supplier-country triad and errors are clustered at the level of the buyer and the country.

Table 3.6a: OLS of Payment Terms on Pre/Post Lehman and Institutions

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	2.230	2.202	2.156	1.063	1.124	1.664	0.569
	[3.79]***	[3.76]***	[3.97]***	[1.53]	[1.56]	[4.63]***	[2.49]**
Post*Low DCBS	-1.174						
	[2.57]**						
Post*Low DCPS		-1.124					
		[2.51]**					
Post*Low PCRC			-1.241				
			[5.23]***				
Post*Low PCBC				1.031			
				[1.38]			
Post*Low CDII					0.927		
					[1.22]		
Post*Low NDC						0.486	
						[0.65]	
Post*Low Financial							1.627
							[3.91]***
GDPpc	-0.000021	-0.000004	-0.000005	-0.000014	0.000005	0.000102	-0.000062
	[0.18]	[0.04]	[0.05]	[0.53]		[1.37]	[0.64]
Order Size	-0.00091	-0.00091	-0.00091	-0.00092	-0.00092	-0.00093	-0.00091
	[11.57]***	[11.63]***	[12.04]***	[12.19]***	[12.19]***	[10.84]***	[11.67]***
N	633,102	633,102	633,102	633,102	633,102	633,102	633,102
R2	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Log pseudolikelihood	-1,759,713	-1,759,805	-1,759,741	-1,760,106	-1,760,254	-1,760,608	-1,759,232

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.6b: OLS of Payment Terms on Pre/Post Lehman, Institutions, and Market Power (Suppliers)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	0.224	0.212	0.445	0.673	0.719	0.003	0.258
	[0.15]	[0.15]	[0.39]	[1.00]	[1.02]	[0.00]	[1.06]
Post*Suppliers	0.070	0.071	0.066	0.068	0.069	0.071	0.062
	[2.49]**	[2.56]**	[3.05]***	[3.99]***	[4.15]***	[4.12]***	[3.73]***
Post*Low DCBS	0.411						
	[0.29]						
Post*Low DCPS		0.441					
		[0.32]					
Post*Low PCRC			0.072				
			[0.07]				
Post*Low PCBC				-0.365			
				[0.33]			
Post*Low CDII					-0.429		
					[0.39]		
Post*Low NDC						1.133	
						[1.27]	
Post*Low Financial							0.379
							[0.44]
gdppc	-0.00016	-0.00016	-0.00018	-0.00016	-0.00015	-0.00020	-0.00020
	[1.06]	[1.05]	[1.16]	[1.26]	[1.17]	[1.12]	[1.32]
Order Size	-0.00089	-0.00089	-0.00088	-0.00089	-0.00089	-0.00087	-0.00088
	[11.22]***	[11.27]***	[11.68]***	[12.02]***	[12.11]***	[10.62]***	[11.48]***
N	625,372	625,372	625,372	625,372	625,372	625,372	625,372
R2	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Log pseudolikelihood	-1,726,148	-1,726,132	-1,726,243	-1,726,174	-1,726,147	-1,725,237	-1,726,173

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.6c: OLS of Payment Terms on Pre/Post Lehman, Institutions, and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	2.930	2.885	2.934	1.835	1.909	2.403	1.310
	[2.48]**	[2.44]**	[2.43]**	[1.57]	[1.61]	[2.38]**	[1.49]
Post*Orders	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[1.35]	[1.34]	[1.39]	[1.38]	[1.37]	[1.39]	[1.42]
Post*Low DCBS	-1.095						
	[2.41]**						
Post*Low DCPS		-1.015					
		[2.51]**					
Post*Low PCRC			-1.286				
			[3.86]***				
Post*Low PCBC				0.990			
				[1.29]			
Post*Low CDII					0.868		
					[1.14]		
Post*Low NDC						0.577	
						[0.79]	
Post*Low Financial							1.655
							[3.72]***
gdppc	0.000036	0.000054	0.000043	0.000041	0.000061	0.000154	-0.000014
	[0.23]	[0.37]	[0.31]	[0.40]	[0.71]	[1.50]	[0.10]
Order Size	-0.00093	-0.00093	-0.00093	-0.00094	-0.00094	-0.00095	-0.00094
	[14.41]***	[14.43]***	[15.51]***	[15.43]***	[15.37]***	[13.59]***	[14.93]***
N	633,102	633,102	633,102	633,102	633,102	633,102	633,102
R2	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Log pseudolikelihood	-1,757,719	-1,757,855	-1,757,526	-1,758,025	-1,758,188	-1,758,401	-1,757,036

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

In Table 3.6a I focus on the change in payment tenor depending on whether an order was issued before or after the start of the financial crisis (as captured by *Post Lehman*) and the effect on payment tenor of the crisis if the order was issued in a country with weak credit markets (Post*Low DCBS, Post* Low DCPC, Post* Low NDC) or weak financial institutions (Post*Low PCRC, Post*Low PCBC, Post*Low DCII, Post*Low Financial Freedom).[55] In most of the regressions (i, ii, iii, vi, and vii), orders issued after the financial crisis began had significantly longer payment tenors ranging from 0.6 days (regression vii) to 2.2 days (regressions i, ii, and iii). Given that mean payment tenor prior to the crisis was 31.1 days, a 2.2 day increase in payment tenor corresponds to a 7.1% increase. In contrast, payment tenors for orders issued to suppliers in countries with weak credit markets increased much less than for orders in countries with strong credit markets. Payment tenors in countries with weak domestic credit from the banking sector (Low DCBS) were on average only 1.1 days (2.23-1.17) longer in contrast to payment tenors in countries with high DCBS which lengthened by 2.2 days (regression i). Identically, payment tenors in countries with weak domestic credit to the private sector grew by only 1.1 days as opposed to 2.2 for countries with high DCPS (regression ii). The results for countries with weak financial institutions are less clear. Payment tenors in countries with low public credit registry coverage (low PCRC) were 0.9 days longer versus countries with high PCRC where tenors grew by 2.2 days (regression iii). However, tenors in countries with weak institutions as measured by Financial Freedom increased after the financial crisis to 2.2 days (0.569+1.627) versus

[55] Note: The variables indicating whether an order took place in a country with weak markets or institutions (e.g. Low DCBS, Low DCPS, etc.) were not included in these specifications because they are perfectly collinear with the buyer-supplier-country fixed effects. For estimates of these coefficients, please see Section 3.6.4.

tenors in countries with high Financial Freedom scores where payment terms grew by only 0.6 days (regression vii). Similar to my findings in the first part of this analysis, in all of the regressions in Tables 3.6a, 3.6b and 3.6c, larger orders had faster payment tenors where an order that was an additional million dollars larger was paid for 0.9 days faster.

In Table 3.6b I look at the role of the size of a buyer's network in a given country on how trade credit terms changed after the crisis. Here I find that, in all regressions, the significance of the overall effect of the financial crisis disappears, as does the moderating role of the institutions. Instead, the number of suppliers a buyer sourced from before the crisis is highly significant. For every additional ten suppliers a buyer sourced from in a given country, he could expect average payment tenors of 0.6 to 0.7 days longer. Consequently, buyers with larger supplier networks were able to extract substantially longer trade credit terms following the financial crisis. I interpret these results to suggest that market power, as measured by the size of a supplier's network, played a substantial role in allowing buyers to extend their payment tenors. In contrast, in Table 3.6c we see that market power, as measured by the total size of buyer's order volume had no significant relationship with payment tenor. In regressions i through vii, the coefficient on the total size of a buyer's orders after the crisis began (Post*Orders) is not significant. However, the average effect of the crisis as measured by the coefficient on Post Lehman, and the moderating effects of the credit markets and institutions are identical to those in Table 3.6a in terms of significance and direction and similar in magnitude.

The results of this second part of my analysis are strongly linked to the results in the first part. Deep credit markets are linked with longer payment tenors over the entire

period and are linked with larger increases in payment tenors after the crisis. Similarly, buyers with large supplier networks in the countries they sourced from before the crisis were able to get longer payment terms, and buyers that reduced the number of suppliers they sourced from also extended their payment terms. Buyer size, as measured by total volume of orders was not significant in any of my regressions. Less clear is the role of financial institutions. No measure of financial institutions in my sample was significant in both the first and second parts of my analysis. Further, the institution that was significant in the first part of my analysis, private credit bureau coverage, is a poor measure of financial institutions because private credit bureaus do not operate in many countries in my sample. Also, in the second stage, the two financial institution measures that were significant operated in opposing directions.

3.6 Robustness

While the results of my analysis are consistent between the two parts, there are many areas of this analysis that could be a cause for concern. Firstly, a discrete dependent variable measured in days could provide biased estimates using ordinary least squares regression. To alleviate this concern I re-conduct my analysis using negative binomial regressions. Secondly, we might be concerned that the creditworthiness of the buyers may be impacting my results. Though this should be less of a concern given that I include buyer and year fixed effects, I re-conduct my analysis using just the buyers in the sample who had publicly available credit ratings. The credit ratings of these buyers did not change during this period. Thirdly, the variety of products that buyers sourced changed after the financial crisis and thus we might be concerned that different products either have systematically different payment terms or might have payment tenors that changed

differently as a results of the crisis. To allay this concern I conduct an analysis of how the mix of products ordered changed after the crisis and how this was related to trade credit terms. Finally, I also re-conduct my analysis without including country fixed effects and clustering in order to estimate the coefficients for the non-interacted variables that I used in the second part of my analysis.

3.6.1 Negative Binomial Regression Results

In Tables 3.7a through 3.7c I reconduct the first part of my analysis using negative binomial regressions instead of ordinary least squares. These regressions include the same buyer, country, and year fixed effects, but I can only cluster errors at the level of the buyer (instead of at the buyer and country level) as tools are not yet available to estimate negative binomial regressions with clustered errors at multiple levels. In all of my negative binomial regressions I report coefficients as incidence-rate ratios.[56] In Table 3.7a I investigate just the role of institutions and find similar results to Table 3.3a. The coefficients on DCBS and DCPS are significant and greater than one which implies that more domestic credit increases the rate at which payment tenor days accrue. A ten percent increase in either DCBS or DCPS as a share of GDP corresponds to the rate at which trade credit terms accrue being increased by a factor of 1.04.[57] In contrast the coefficient on PCBC is less than one implying that a ten percent increase in PCBC coverage decreases the rate at which payment tenor days accrue by a factor of 1.03.[58] As

[56] A coefficient greater than one implies that an increase in the independent variable increases the rate at which the dependent variable accumulates.

[57] 1.004^10

[58] (1/0.997)^10

before, an increase in GDP per capita is associated with a higher rate of accumulation of payment tenor days.

Table 3.7a: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman and Institutions

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
DCBS	1.0040						
	[3.69]***						
DCPS		1.0044					
		[3.68]***					
PCRC			1.0001				
			[0.04]				
PCBC				0.9970			
				[1.75]*			
CDII					1.0254		
					[0.94]		
NDC						1	
						[0.24]	
Financial Freedom							0.9956
							[1.17]
GDPpc	1.000025	1.000015	1.000032	1.000029	1.000034	1.000035	1.000035
	[1.77]*	[1.12]	[1.80]*	[1.88]*	[2.12]**	[1.88]*	[2.20]**
Order Size	0.999980	0.999981	0.999978	0.999974	0.999978	0.999978	0.999979
	[1.35]	[1.33]	[1.58]	[2.20]**	[1.55]	[1.56]	[1.51]
N	635,740	635,740	634,949	600,957	634,949	635,740	635,215
Log pseudolikelihood	-2,158,256	-2,158,597	-2,159,181	-2,052,491	-2,158,903	-2,161,686	-2,159,633

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer, country, and year fixed effects. Errors are clustered by buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

Table 3.7b: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Suppliers)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Suppliers	0.9990	0.9989	0.9992	0.9990	0.9993	0.9992	0.9992
	[2.52]**	[2.88]***	[1.78]*	[2.31]**	[1.70]*	[1.56]	[1.97]**
DCBS	1.0043						
	[4.09]***						
DCPS		1.0050					
		[4.50]***					
PCRC			1.0009				
			[0.25]				
PCBC				0.9970			
				[1.76]*			
CDII					1.0223		
					[0.81]		
NDC						1	
						[0.11]	
Financial Freedom							0.9950
							[1.41]
GDPpc	1.000029	1.000018	1.000034	1.000034	1.000037	1.000035	1.000039
	[2.07]**	[1.35]	[1.93]*	[2.11]**	[2.39]**	[1.84]*	[2.60]***
Order Size	0.99998	0.99998	0.99998	0.99997	0.99998	0.99998	0.99998
	[1.36]	[1.33]	[1.59]	[2.27]**	[1.56]	[1.56]	[1.52]
N	635,740	635,740	634,949	600,957	634,949	635,740	635,215
Log pseudolikelihood	-2,157,195	-2,157,250	-2,158,531	-2,051,264	-2,158,340	-2,161,056	-2,158,923

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer, country, and year fixed effects. Errors are clustered by buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

Table 3.7c: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Orders	0.99995	0.99995	0.99995	0.99996	0.99995	0.99995	0.99995
	[1.52]	[1.52]	[1.51]	[1.03]	[1.46]	[1.50]	[1.50]
DCBS	1.0039						
	[3.35]***						
DCPS		1.0043					
		[3.38]***					
PCRC			0.9998				
			[0.05]				
PCBC				0.9967			
				[1.75]*			
CDII					1.0199		
					[0.71]		
NDC						1	
						[0.09]	
Financial Freedom							0.9958
							[1.15]
GDPpc	1.000028	1.000018	1.000035	1.000030	1.000036	1.000036	1.000037
	[2.02]**	[1.38]	[2.12]**	[1.97]**	[2.33]**	[1.92]*	[2.45]**
Order Size	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998
	[1.28]	[1.26]	[1.51]	[2.13]**	[1.48]	[1.48]	[1.44]
N	635,740	635,740	634,949	600,957	634,949	635,740	635,215
Log pseudolikelihood	-2,156,609	-2,156,952	-2,157,439	-2,051,532	-2,157,269	-2,159,968	-2,157,907

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer, country, and year fixed effects. Errors are clustered by buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

As expected, these results also hold true in Tables 3.7b and 3.7c, much as they did in Table 3.3b and 3.3c. We also see that the number of suppliers a buyer sources from in a given country is negatively associated with the rate at which tenor days accumulate. If a buyer sources from ten additional suppliers, the rate at which that order's tenor length increases declined by a factor of 1.01.[59] This is similar to the result we found in Table 3.3b. In Table 3.7c we see that a buyer's total yearly sourcing volume does not have a statistically significant impact on the length of payment tenor, much as we did in Table 3.3c.

I next re-conduct the second part of my analysis using negative binomial regressions and present my results in Tables 3.8a, 3.8b and 3.8c. The results are identical in direction as the results in Tables 3.6a, 3.6b and 3.6c. In Table 3.8a, the fact that an order was issued after the crisis implied that it accrued payment tenor days at a faster rate, but orders issued in countries with weak capital markets, as measured by DCBS and DCPS, and financial institutions, as measured by PCRC, accrued days more slowly after the crisis than their counterparts. Orders issued in countries with a low value of Financial Freedom increased the rate at which they accumulated tenor days after the crisis. All of these results are comparable to my results in Table 3.6a, except that the significance of the coefficient on Post Lehman is reduced to the 5% level in regressions i and ii, while the significance of the coefficient on Post*Low Financial Freedom is reduced to the 10% level.[60] The results in Table 3.8b are equally comparable to the results in Table 3.6b except that the coefficient on Post*Suppliers loses significance in regressions i-iii, and

[59] (1/0.999)^10

[60] This can, in large part, be attributed to the reduction in the number of clusters that results from clustering at one, instead of two, levels.

the significance of the coefficient on order size falls from the 1% level to the 10% level. The results in Table 3.8c are, similarly, comparable to the results in 3.7c, except that the coefficient on Post Lehman weakens to the 10% level in regressions i-iii and the coefficient on Post*Low Financial weakens to the 10% level in regression vii. Overall, the results of estimating my model using negative binomial regression are highly similar to my results using ordinary least squares.

Table 3.8a: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman and Institutions

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	1.088	1.087	1.085	1.048	1.047	1.063	1.022
	[2.44]**	[2.42]**	[2.68]***	[1.42]	[1.33]	[1.97]**	[0.83]
Post*Low DCBS	0.939						
	[2.45]**						
Post*Low DCPS		0.938					
		[2.44]**					
Post*Low PCRC			0.934				
			[3.11]***				
Post*Low PCBC				1.0203			
				[0.56]			
Post*Low CDII					1.0210		
					[0.57]		
Post*Low NDC						0.9992	
						[0.02]	
Post*Low Financial							1.0538
							[1.69]*
GDPpc	1.000013	1.000013	1.000012	1.000018	1.000018	1.000020	1.000014
	[1.11]	[1.20]	[1.02]	[1.40]	[1.44]	[1.62]	[1.16]
Order Size	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998
	[1.49]	[1.49]	[1.52]	[1.64]	[1.64]	[1.64]	[1.61]
N	633,184	633,184	633,184	633,184	633,184	633,184	633,184
Log pseudolikelihood	-2,157,426	-2,157,389	-2,157,345	-2,158,684	-2,158,680	-2,158,792	-2,158,093

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and country fixed effects. Errors are clustered by Buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

Table 3.8b: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Suppliers)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	1.0302	1.0313	1.0344	1.0293	1.0291	1.0051	1.0148
	[0.55]	[0.58]	[0.81]	[0.92]	[0.87]	[0.13]	[0.58]
Post*Suppliers	1.0021	1.0020	1.0020	1.0024	1.0024	1.0025	1.0022
	[1.35]	[1.34]	[1.45]	[2.26]**	[2.25]**	[2.30]**	[2.02]**
Post*Low DCBS	0.9824						
	[0.35]						
Post*Low DCPS		0.9801					
		[0.40]					
Post*Low PCRC			0.9704				
			[0.73]				
Post*Low PCBC				0.9822			
				[0.47]			
Post*Low CDII					0.9834		
					[0.43]		
Post*Low NDC						1.0347	
						[0.98]	
Post*Low Financial							1.0074
							[0.21]
GDPpc	1.000007	1.000007	1.000006	1.000010	1.000009	1.000007	1.000007
	[0.57]	[0.57]	[0.47]	[0.77]	[0.74]	[0.54]	[0.59]
Order Size	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998
	[1.73]*	[1.72]*	[1.74]*	[1.77]*	[1.77]*	[1.72]*	[1.75]*
N	625,446	625,446	625,446	625,446	625,446	625,446	625,446
Log pseudolikelihood	-2,122,170	-2,122,145	-2,122,020	-2,122,178	-2,122,188	-2,121,890	-2,122,241

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and country fixed effects. Errors are clustered by Buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

Table 3.8c: Negative Binomial Regression of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	1.0974	1.0963	1.0974	1.0594	1.0585	1.0737	1.0328
	[1.76]*	[1.74]*	[1.82]*	[1.16]	[1.11]	[1.42]	[0.77]
Post*Orders	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999
	[0.50]	[0.48]	[0.59]	[0.54]	[0.53]	[0.55]	[0.55]
Post*Low DCBS	0.9401						
	[2.53]**						
Post*Low DCPS		0.9396					
		[2.57]**					
Post*Low PCRC			0.9332				
			[3.03]***				
Post*Low PCBC				1.0190			
				[0.54]			
Post*Low CDII					1.0196		
					[0.55]		
Post*Low NDC						1.0014	
						[0.04]	
Post*Low Financial							1.0537
							[1.70]*
GDPpc	1.000013	1.000014	1.000013	1.000018	1.000019	1.000021	1.000014
	[1.12]	[1.20]	[1.03]	[1.41]	[1.44]	[1.60]	[1.17]
Order Size	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998
	[1.52]	[1.51]	[1.55]	[1.67]*	[1.67]*	[1.67]*	[1.64]
N	633,184	633,184	633,184	633,184	633,184	633,184	633,184
Log pseudolikelihood	-2,157,253	-2,157,232	-2,157,099	-2,158,475	-2,158,473	-2,158,570	-2,157,875

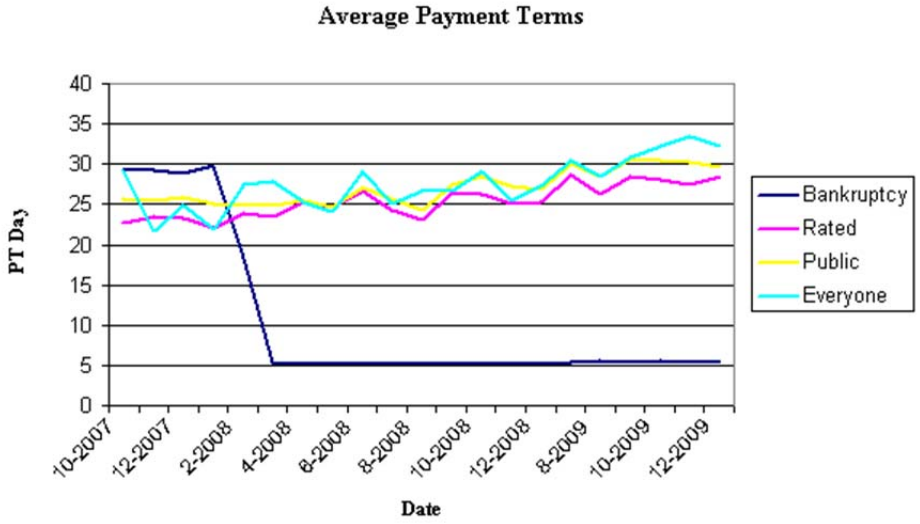
*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include buyer and country fixed effects. Errors are clustered by Buyer. z-statistics in parentheses. Coefficients are incidence-rate ratios.

3.6.2 Buyer Creditworthiness

Another concern we may have with my results is that the increase in payment terms after the financial crisis reflects not the change in market power between the buyer and the supplier, but a change in the creditworthiness of the buyer. This is an unlikely explanation because, in order for payment terms to have lengthened as we have seen, buyer credit worthiness would have had to have improved during the financial crisis, at a time when demand had fallen and buyers were cutting back on orders. Nonetheless, it is interesting to investigate further how buyer creditworthiness evolved during the period in my sample. In my sample, seven out of the 22 buyers were public companies, and out of these four had debt rated by Standard & Poor's, ranging from B+ to A+. The ratings of these four buyers did not change during the period in my sample. However, one of the non-rated, publicly listed firms filed for bankruptcy protection late in the summer of 2008. In Figure 3.2 I plot the (non-weighted) average payment terms by month for all orders for the firm that filed for bankruptcy protection, just the rated buyers, all of the public buyers, and the entire sample. In this graph we see that payment terms for the firm that filed for bankruptcy shortened dramatically – to just over five days – as the credit worthiness of that firm fell. However, for all other categories, payment terms lengthened, even for the rated buyers whose credit ratings did not change over the period.

Figure 3.2: Average Payment Terms by Groups of Buyers



To ensure that changes in buyer creditworthiness are not driving my results I reconduct my analysis using just the four publicly-traded buyers in my sample whose debt was rated by the S&P. The debt ratings for all four of these firms did not vary throughout the time in my sample and consequently, if the results are similar in this sample, we can safely assume that they are not being driven by changes in buyer creditworthiness. Overall, I find that my results using this restricted sample are similar in direction and broadly similar in significance and magnitude to my results in the full sample.

In Tables 3.9a through 3.9c I reconduct my regressions in Tables 3.3a through 3.3c except that I limit the sample to these four buyers. With this smaller sample, occasionally there was not enough variation by a particular independent variable to get a standard error estimate for the coefficient. In all three of these tables we see that deeper credit markets as measured by DCBS corresponds to longer payment terms, as do stronger financial institutions as measured by public credit registry coverage (PCRC). In

constrast stronger financial institutions as measured by private credit bureau coverage (PCBC) and Financial Freedom. Unlike in Tables 3.3a through 3.3c, DCPS is not always significant because standard error estimates are not available in Tables 3.9a and 3.9b, and a country's net domestic credit (NDC) is significant and positively related to payment tenor length which it is not elsewhere in this analysis. Also in contrast to my earlier results, the number of suppliers a buyer sources from loses its significance. However, I attribute this to the reduction in the number of buyers and the presence of both buyer fixed effects and clustering at the buyer (and country) level.

Table 3.9a: OLS of Payment Tenor on Institutions, Rated Buyers

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
DCBS	0.086						
	[6.27]***						
DCPS		0.133					
		[.]					
PCRC			0.234				
			[2.48]**				
PCBC				-0.260			
				[4.67]***			
CDII					-0.115		
					[0.14]		
NDC						0	
						[.]	
Financial Freedom							-0.340
							[6.00]***
GDPpc	0.0012	0.0009	0.0009	0.0007	0.0013	0.0009	0.0016
	[1.66]*	[1.30]	[1.38]	[0.96]	[1.66]*	[1.22]	[2.13]**
Order Size	-0.00074	-0.00071	-0.00072	-0.00071	-0.00077	-0.00074	-0.00075
	[3.18]***	[3.08]***	[3.65]***	[3.39]***	[3.49]***	[3.47]***	[3.41]***
N	371040	371040	370571	347018	370571	371040	370837
R2	0.33	0.34	0.33	0.34	0.32	0.32	0.32
Log pseudolikelihood	-1,025,907	-1,023,366	-1,024,648	-963,545	-1,027,632	-1,027,295	-1,025,757

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.9b: OLS of Payment Tenor on Institutions and Market Power (Suppliers), Rated Buyers

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Suppliers	-0.0018	-0.0117	-0.0008	0.0077	0.0087	-0.0056	0.0041
	[0.11]	[0.77]	[0.06]	[0.59]	[0.61]	[0.33]	[0.26]
DCBS	0.087						
	[4.46]***						
DCPS		0.142					
		[.]					
PCRC			0.235				
			[2.35]**				
PCBC				-0.258			
				[4.51]***			
CDII					-0.073		
					[0.10]		
NDC						0	
						[3.88]***	
Financial Freedom							-0.336
							[4.16]***
GDPpc	0.00116	0.00090	0.00089	0.00066	0.00126	0.00092	0.00154
	[1.48]	[1.24]	[1.26]	[0.86]	[1.49]	[1.22]	[1.85]*
Order Size	-0.00074	-0.00072	-0.00072	-0.00071	-0.00076	-0.00074	-0.00074
	[3.04]***	[2.96]***	[3.47]***	[3.23]***	[3.35]***	[3.36]***	[3.27]***
N	371,040	371,040	370,571	347,018	370,571	371,040	370,837
R2	0.33	0.34	0.33	0.34	0.32	0.32	0.32
Log pseudolikelihood	-1,025,903	-1,023,180	-1,024,647	-963,458	-1,027,521	-1,027,256	-1,025,733

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.9c: OLS of Payment Tenor on Institutions and Market Power (Orders), Rated Buyers

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Orders	-0.0012	-0.0012	-0.0012	-0.0015	-0.0014	-0.0014	-0.0014
	[1.02]	[1.08]	[1.02]	[1.22]	[1.09]	[1.18]	[1.15]
DCBS	0.079						
	[2.87]***						
DCPS		0.127					
		[6.23]***					
PCRC			0.219				
			[2.60]***				
PCBC				-0.275			
				[4.37]***			
CDII					-0.115		
					[0.14]		
NDC						0	
						[4.18]***	
Financial Freedom							-0.355
							[5.04]***
GDPpc	0.0013	0.0010	0.0011	0.0008	0.0015	0.0011	0.0017
	[1.63]	[1.35]	[1.46]	[1.00]	[1.69]*	[1.34]	[2.08]**
Order Size	-0.00072	-0.00070	-0.00071	-0.00069	-0.00075	-0.00072	-0.00073
	[3.45]***	[3.39]***	[3.93]***	[3.75]***	[3.79]***	[4.11]***	[3.77]***
N	371,040	371,040	370,571	347,018	370,571	371,040	370,837
R2	0.33	0.34	0.33	0.35	0.32	0.33	0.33
Log pseudolikelihood	-1,024,142	-1,021,673	-1,022,852	-961,082	-1,025,453	-1,024,941	-1,023,330

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer, Supplier, and Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

When I reconduct the second part of my analysis using just these four buyer, again my results, presented in Tables 3.10a through 3.10c, are largely similar to my results in Tables 3.6a through 3.6c. The largest difference here is that the moderating effect on the lengthening of payment terms disappears because the coefficients on Post*Low DCBS and Post*LowDCPS are no longer significant. However, as before weak credit registry coverage reduced the degree to which tenor lengthened after the crisis began while a low measure of Financial Freedom increased them. However, in this sample, both low private credit bureau coverage and a low credit depth of information score corresponded to longer payment tenors after the crisis. In terms of market power, again, buyers with more suppliers prior to the crisis were able to extract longer payment tenors after the crisis. However, in Table 3.10c we also see that, among these four buyers, the buyers who increased their sourcing volume the most lengthened their payment tenors less than the buyers who did not sourcing volume.

Table 3.10a: OLS of Payment Tenor on Pre/Post Lehman and Institutions, Rated Buyers

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	2.278	2.292	2.188	0.510	0.531	1.836	0.420
	[8.47]***	[8.42]***	[5.97]***	[6.07]***	[5.88]***	[8.84]***	[3.93]***
Post*Low DCBS	-1.510						
	[.]						
Post*Low DCPS		-1.532					
		[.]					
Post*Low PCRC			-1.884				
			[6.05]***				
Post*Low PCBC				1.630			
				[4.34]***			
Post*Low CDII					1.589		
					[4.33]***		
Post*Low NDC						-0.312	
						[0.86]	
Post*Low Financial							1.652
							[4.81]***
GDPpc	0.00036	0.00036	0.00039	0.00033	0.00033	0.00048	0.00035
	[2.11]**	[2.09]**	[2.36]**	[1.78]*	[1.76]*	[2.74]***	[1.97]**
Order Size	-0.00095	-0.00095	-0.00095	-0.00096	-0.00096	-0.00099	-0.00096
	[21.45]***	[21.61]***	[22.19]***	[21.61]***	[21.51]***	[21.44]***	[21.67]***
N	368,479	368,479	368,479	368,479	368,479	368,479	368,479
R2	0.12	0.12	0.12	0.12	0.12	0.10	0.11
Log pseudolikelihood	-851,631	-851,536	-850,921	-851,939	-852,128	-854,366	-852,203

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.10b: OLS of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Suppliers), Rated Buyers

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	1.403	1.435	1.475	0.286	0.294	0.579	0.222
	[2.23]**	[2.25]**	[2.97]***	[.]	[26.74]***	[1.69]*	[3.10]***
Post*Suppliers	0.027	0.026	0.025	0.030	0.031	0.044	0.031
	[3.36]***	[3.23]***	[.]	[.]	[.]	[.]	[.]
Post*Low DCBS	-0.791						
	[1.41]						
Post*Low DCPS		-0.826					
		[1.46]					
Post*Low PCRC			-1.295				
			[2.72]***				
Post*Low PCBC				1.017			
				[1.92]*			
Post*Low CDII					0.973		
					[1.88]*		
Post*Low NDC						0.448	
						[1.02]	
Post*Low Financial							1.007
							[2.08]**
GDPpc	0.00028	0.00028	0.00029	0.00023	0.00023	0.00027	0.00024
	[1.50]	[1.50]	[1.60]	[1.23]	[1.20]	[1.51]	[1.30]
Order Size	-0.00095	-0.00095	-0.00095	-0.00095	-0.00095	-0.00095	-0.00095
	[24.63]***	[24.39]***	[25.65]***	[26.04]***	[26.20]***	[23.60]***	[26.57]***
N	366,640	366,640	366,640	366,640	366,640	366,640	366,640
R2	0.12	0.12	0.13	0.12	0.12	0.12	0.12
Log pseudolikelihood	-847,179	-847,144	-846,384	-846,827	-846,902	-847,429	-846,927

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

Table 3.10c: OLS of Payment Tenor on Pre/Post Lehman, Institutions, and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	4.560	4.567	4.451	2.998	3.025	4.166	2.865
	[3.33]***	[3.32]***	[2.87]***	[1.94]*	[1.94]*	[2.80]***	[1.81]*
Post*Orders	-0.00133	-0.00133	-0.00132	-0.00129	-0.00130	-0.00134	-0.00131
	[2.41]**	[2.41]**	[2.32]**	[2.18]**	[2.18]**	[2.21]**	[2.23]**
Post*Low DCBS	-1.439						
	[.]						
Post*Low DCPS		-1.452					
		[.]					
Post*Low PCRC			-1.769				
			[.]				
Post*Low PCBC				1.308			
				[.]			
Post*Low CDII					1.270		
					[.]		
Post*Low NDC						0	
						[.]	
Post*Low Financial							1.446
							[.]
gdppc	0.00051	0.00051	0.00054	0.00050	0.00050	0.00063	0.00051
	[3.31]***	[3.28]***	[3.91]***	[3.03]***	[3.00]***	[4.35]***	[3.28]***
Order Size	-0.0009	-0.0009	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010
	[33.33]***	[33.48]***	[31.67]***	[30.63]***	[30.72]***	[30.51]***	[31.23]***
N	368,479	368,479	368,479	368,479	368,479	368,479	368,479
R2	0.17	0.17	0.17	0.16	0.16	0.16	0.17
Log pseudolikelihood	-840,437	-840,371	-839,854	-841,464	-841,605	-843,071	-841,337

*** p<0.1; ** p<0.05; *** p<0.01**

Note: Regressions include Buyer*Supplier*Country fixed effects. Errors are clustered by Buyer and Country. t-statistics in parentheses.

3.6.3 Product Mix

Another concern with my data is that the types of products that buyers were sourcing changed during the financial crisis and that these shifts in the product mix might be correlated with the changes I find in payment tenor. For example, if buyers started sourcing a good that typically has a long payment tenor – and which is only produced in countries with strong markets and institutions – more heavily after the crisis, this would provide an alternate explanation for why tenor lengthened, and lengthened more in countries with stronger institutions. To address this concern, I first identify the categories of goods in which sourcing changed substantially before and after the crisis. I then look to see whether or not the payment tenor for these goods was significantly different than for all other categories. Finally, I check whether the payment tenor for these goods changed significantly as a result of the financial crisis.

To carry out this analysis I first identify which categories of product were ordered using the US Harmonized Tariff Schedule (HTS) codes reported on some orders. Unfortunately I am limited to looking at the 117,382 orders in my sample that listed HTS information. The breakdown of orders by 2 digit HTS category is reported in Table 3.11. Here we see that four categories changed significantly in terms of the share of orders that were sourced before and after the crisis. The share of orders in categories 94 (furniture) and 33 (cosmetics) declined while the share of orders in 62 (non-knitted or crocheted apparel) and 64 (footwear) increased.

Table 3.11: Comparison of the Distribution of Orders by Product Category Before and After Lehman's Bankruptcy

2 Digit HTS Code	Pre Lehman Orders	Post Lehman Orders	%Pre Lehman	%Post Lehman	Change in %
94	5,596	2,453	9.1	4.4	-4.7
33	3,168	1,234	5.1	2.2	-2.9
95	418	158	0.7	0.3	-0.4
61	33,313	29,848	53.9	53.7	-0.2
34	132	4	0.2	0.0	-0.2
73	90	18	0.2	0.0	-0.1
85	52	4	0.1	0.0	-0.1
48	32	15	0.1	0.0	0.0
71	4		0.0		0.0
32	1		0.0		0.0
70		1		0.0	0.0
82	1		0.0		0.0
49		3		0.0	0.0
63	3	6	0.0	0.0	0.0
96	1	7	0.0	0.0	0.0
39	50	57	0.1	0.1	0.0
99		21		0.0	0.0
42	545	515	0.9	0.9	0.1
65	274	325	0.4	0.6	0.1
62	9,267	9,708	15.0	17.5	2.5
64	8,851	11,207	14.3	20.2	5.8
Total	61,798	55,584			

To see whether this had an impact on my results, I conduct a series of means tests to see whether the payment tenors of orders in these categories was significantly different than the means of the entire sample of data that contained HTS information. In Table 3.12a I compare the average payment tenor in each of these four categories with the rest of the population and see that only category 62 had an average payment tenor that was longer than the rest of the sample. I also compare the average payment tenor of the orders in categories 62 and 64 with the payment tenor in categories 33 and 94 and find that the tenor in the categories whose orders decreased (the latter) were significantly shorter than in the categories which increased (the former). This would suggest that the shift in product mix was a significant cause of the lengthening in payment terms that we have seen.

Table 3.12a: T-test of Payment Tenor Length by 2 Digit HTS Code

2 Digit HTS Code	N (not HTS)	N (in HTS)	Mean (not in HTS)	Mean (in HTS)	t
94	109,333	8,049	38.66	12.65	213.6
33	112,980	4,402	36.95	35	10.2
62	98,407	18,975	36.01	41.07	-53.2
64	97,324	20,058	37.59	33.14	45.7
62&64 vs. 94&33	39,033	12,451	37.21	20.55	121.2

However, this analysis does not take into account the fact that different buyers source different amounts from each category and that different categories are sourced from different countries and in different years. It could be the case that, for example, a buyer with particularly long tenors is responsible for most of the ordering in a particular category, or that most orders in a particular category are sourced from a country with, on average unusually long payment tenors. To correct for this, I subtract the mean payment tenor for each buyer-country-year combination from each order's payment tenor and then compare the average payment tenor for each category against the rest of the sample. I also compare the de-meaned average payment tenor for the categories that lost share versus the categories that gained share. I present the results in Table 3.12b. Here we see that neither of the categories that lost share had average payment terms that were significantly different from the sample as a whole. Of the categories that gained share, Category 62 had tenors that were, on average shorter, and Category 64 had tenors that were on average, longer. When I compare the average de-meaned payment tenor for the categories that lost share and the categories that gained share, I find that they are not statistically different. This analysis, which conducts a more accurate comparison of the categories, suggests that the change in product mix is not driving my results.

Table 3.12b: T-test of De-Meaned Payment Tenor Length by 2 Digit HTS Code

2 Digit HTS Code	N (not HTS)	N (in HTS)	Mean (not in HTS)	Mean (in HTS)	t
94	109,333	8,049	-0.069	0.014	-1.007
33	112,980	4,402	-0.066	0	-0.604
62	98,407	18,975	0.241	-1.640	33.400
64	97,324	20,058	-0.358	1.363	-31.200
62&64 vs. 94&33	39,033	12,451	-0.098	0.009	-1.082

Note: Payment Tenor is demeaned by buyer, country, and year

To investigate this issue further, I also look at how payment terms changed in these categories before and after the financial crisis. In Table 3.12c I look at the average payment tenor in each category before and after the crisis and see that none of these categories had payment terms that were longer after the crisis than before the crisis. I also re-conduct this analysis using de-meaned payment tenors (in Table 3.12d) and similarly find that none of the tenors increased in these categories. Also only two of the categories, 94 and 64, had a statistically significant change. While these analyses are not sufficient to conclusively prove that changes in product mix do not affect my results, they strongly suggest that changes in product mix were, at most, a minor factor.

Table 3.12c: T-test of Payment Tenor Length Pre/Post Lehman by 2 Digit HTS Code

2 Digit HTS Code	N (pre crisis)	N (post crisis)	Mean (pre crisis)	Mean (post crisis)	t
94	5,596	2,453	15.79	5.49	41.31
33	3,168	1,234	35	35	
62	9,267	9,708	33.55	32.74	5.374
64	8,851	11,207	41.33	40.87	2.27
94 & 33	8,764	3,687	22.73	15.36	27.53
62 & 64	18,118	20,915	37.35	37.1	1.9

Table 3.12d: T-test of De-Meaned Payment Tenor Length Pre/Post Lehman by 2 Digit HTS Code

2 Digit HTS Code	N (pre crisis)	N (post crisis)	Mean (pre crisis)	Mean (post crisis)	t
94	5,596	2,453	0.918	-2.05	15.98
33	3,168	1,234	0	0	
62	9,267	9,708	-1.58	-1.703	1.19
64	8,851	11,207	1.78	1.036	4.16
94 & 33	8,764	3,687	0.586	-1.36	16.02
62 & 64	18,118	20,915	0.061	-0.235	2.808

Note: Payment Tenor is demeaned by buyer, country, and year

3.6.4 Analysis without Country Fixed Effects

When using fixed effects at the buyer-supplier-country level in my regressions in Table 3.6a through 3.6c (and corresponding tables) it was not possible to get coefficient estimates on many of the non-interacted independent variables because the variables were perfectly collinear with the fixed effects. Consequently, in these tables we could see the effect on change in payment tenor of being in a country with weak institutions or credit markets before and after the financial crisis. We could not, however, see the overall effect of being in a country with these weak institutions or markets in these regressions.[61] To

[61] We could see the overall effect in Tables 3.3a through 3.3c and related tables.

verify that the non-interacted independent variables were also significant in the cases where the interacted variables were I reconducted these analyses using just buyer fixed effects and clustering errors at the buyer level. The results of these regressions are in Tables 3.13a through 3.13c. In almost all cases we see that, when there was a statistically significant interaction, the non-interacted independent variable components of that interaction were also significant. In Table 3.13a in regressions i-iii, Low DCBS, Low DCPS, and Low PCRC were statistically significant on their own as well as when they were interacted with Post Lehman. Similarly, in Table 3.13b, the coefficient on Suppliers was significant in all regressions except regression ii, in addition to when Suppliers was interacted with Post Lehman. The notable exception to this is my Low Financial Freedom variable which is not significant on its own but is significant when interacted with Post Lehman.

Table 3.13a: OLS of Payment Tenor on Pre/Post Lehman and Institutions

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	2.377	2.413	2.107	0.586	0.508	1.692	-0.537
	[2.65]***	[2.67]***	[2.64]***	[0.58]	[0.47]	[1.94]*	[0.59]
Low DCBS	2.901						
	[2.98]***						
Post*Low DCBS	-2.813						
	[2.98]***						
Low DCPS		3.128					
		[2.56]**					
Post*Low DCPS		-2.991					
		[3.38]***					
Low PCRC			2.460				
			[2.63]***				
Post*Low PCRC			-2.522				
			[3.13]***				
Low PCBC				-2.078			
				[2.87]***			
Post*Low PCBC				1.202			
				[1.28]			
Low CDII					-1.653		
					[2.14]**		
Post*Low CDII					1.250		
					[1.23]		
Low NDC						-0.308	
						[0.40]	
Post*Low NDC						-0.797	
						[0.78]	
Low Financial Freedom							-1.456
							[1.07]
Post*Low Financial							2.539
							[2.83]***
GDPpc	0.000016	0.000033	-0.000010	-0.000034	-0.000010	0.000005	0.000003
	[0.22]	[0.40]	[0.16]	[0.41]	[0.14]	[0.05]	[0.06]
Order Size	-0.00057	-0.00053	-0.00066	-0.00070	-0.00073	-0.00083	-0.00079
	[2.72]***	[2.67]***	[3.15]***	[2.69]***	[2.98]***	[2.98]***	[3.63]***
N	633,184	633,184	633,184	633,184	633,184	633,184	633,184
R2	0.03	0.03	0.02	0.02	0.01	0.01	0.02
Log pseudolikelihood	-2,104,664	-2,103,699	-2,107,164	-2,109,116	-2,109,739	-2,110,460	-2,109,303

* p<0.1; ** p<0.05; *** p<0.01

Note: Regressions include buyer fixed effects and errors are clustered by buyer.
t-statistics in parentheses.

Table 3.13b: OLS of Payment Tenor on Pre/Post Lehman, Institutions and Market Power (Suppliers)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	0.352	0.500	0.097	0.054	0.025	-0.259	-0.451
	[0.22]	[0.31]	[0.09]	[0.06]	[0.02]	[0.23]	[0.57]
Suppliers	-0.039	-0.031	-0.057	-0.067	-0.069	-0.086	-0.069
	[1.90]*	[1.00]	[3.91]***	[5.33]***	[4.93]***	[5.53]***	[4.04]***
Post*Suppliers	0.074	0.071	0.080	0.086	0.086	0.085	0.078
	[2.00]**	[1.85]*	[2.80]***	[3.16]***	[3.06]***	[3.62]***	[2.66]***
Low DCBS	1.972						
	[1.47]						
Post*Low DCBS	-0.778						
	[0.49]						
Low DCPS		2.356					
		[1.25]					
Post*Low DCPS		-1.043					
		[0.67]					
Low PCRC			1.270				
			[1.17]				
Post*Low PCRC			-0.466				
			[0.47]				
Low PCBC				-0.715			
				[0.90]			
Post*Low PCBC				-0.244			
				[0.24]			
Low CDII					-0.404		
					[0.48]		
Post*Low CDII					-0.215		
					[0.18]		
Low NDC						-1.458	
						[2.29]**	
Post*Low NDC						0.550	
						[0.58]	
Low Financial Freedom							-0.273
							[0.19]
Post*Low Financial							0.584
							[0.50]
GDPpc	0.000001	0.000019	-0.000028	-0.000037	-0.000024	-0.000042	-0.000015
	[0.01]	[0.19]	[0.38]	[0.41]	[0.30]	[0.50]	[0.25]
Order Size	-0.00053	-0.00051	-0.00055	-0.00055	-0.00057	-0.00048	-0.00058
	[2.58]***	[2.58]***	[2.67]***	[2.41]**	[2.57]**	[1.74]*	[2.70]***
N	625,446	625,446	625,446	625,446	625,446	625,446	625,446
R2	0.04	0.04	0.04	0.04	0.04	0.04	0.03
Log pseudolikelihood	-2,063,589	-2,062,929	-2,064,778	-2,065,438	-2,065,673	-2,064,293	-2,065,789

* p<0.1; ** p<0.05; *** p<0.01
Note: Regressions include buyer fixed effects and errors are clustered by buyer.
t-statistics in parentheses.

Table 3.13c: OLS of Payment Tenor on Pre/Post Lehman, Institutions and Market Power (Orders)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Post Lehman	1.882	1.885	1.735	0.166	0.091	1.284	-0.865
	[1.14]	[1.16]	[1.11]	[0.10]	[0.05]	[0.79]	[0.55]
Orders	-0.0019	-0.0019	-0.0018	-0.0018	-0.0018	-0.0019	-0.0018
	[3.58]***	[3.66]***	[3.38]***	[3.37]***	[3.37]***	[3.42]***	[3.36]***
Post*Orders	-0.00032	-0.00029	-0.00040	-0.00036	-0.00037	-0.00036	-0.00040
	[0.54]	[0.49]	[0.68]	[0.60]	[0.60]	[0.57]	[0.68]
Low DCBS	2.916						
	[3.00]***						
Post*Low DCBS	-2.774						
	[2.92]***						
Low DCPS		3.158					
		[2.58]***					
Post*Low DCPS		-2.972					
		[3.36]***					
Low PCRC			2.451				
			[2.65]***				
Post*Low PCRC			-2.492				
			[3.19]***				
Low PCBC				-2.084			
				[2.94]***			
Post*Low PCBC				1.201			
				[1.29]			
Low CDII					-1.661		
					[2.18]**		
Post*Low CDII					1.250		
					[1.23]		
Low NDC						-0.269	
						[0.35]	
Post*Low NDC						-0.895	
						[0.87]	
Low Financial Freedom							-1.444
							[1.07]
Post*Low Financial							2.496
							[2.82]***
GDPpc	0.000017	0.000034	-0.000010	-0.000033	-0.000010	0.000005	0.000004
	[0.22]	[0.41]	[0.15]	[0.41]	[0.13]	[0.06]	[0.07]
Order Size	-0.00055	-0.00052	-0.00066	-0.00069	-0.00072	-0.00082	-0.00078
	[2.64]***	[2.59]***	[3.07]***	[2.63]***	[2.92]***	[2.90]***	[3.55]***
N	633,184	633,184	633,184	633,184	633,184	633,184	633,184
R2	0.04	0.04	0.03	0.03	0.02	0.02	0.02
Log pseudolikelihood	-2,101,607	-2,100,565	-2,104,228	-2,106,147	-2,106,772	-2,107,444	-2,106,411

* p<0.1; ** p<0.05; *** p<0.01
Note: Regressions include buyer fixed effects and errors are clustered by buyer.
t-statistics in parentheses.

3.7 Discussion

In this chapter I set out to examine the role that credit markets, financial institutions, and market power had on trade credit terms because the effect of these factors has been poorly understood and insufficiently tested in the existing literature. To do this I use a unique set of international contract manufacturing orders that is the first to have sufficient country, buyer, and supplier variation to reasonably test the affects that credit markets, financial institutions, and market power have. Further, in addition to testing how payment tenor varies according to these factors, I also use the financial crisis as a quasi-natural experiment that allows me to examine how these factors influence how the parties adjusted their trade credit terms. In my analysis I find that credit markets and the size of a buyer's local supplier network substantially affected the trade credit terms on an order, and also affected how those terms adjusted in response to the financial crisis. Suppliers in countries with deep credit markets offered significantly longer payment tenors on their orders, and for orders between a given buyer and supplier in a given country payment tenors lengthened substantially when the country had deeper credit markets. In the case of market power, a buyer received longer trade credit terms when he reduced the number of suppliers he sourced from in a given country, and payment tenors lengthened after the financial crisis between a buyer and a supplier in a given country, when that buyer had a larger number of suppliers in that country prior to the crisis. In contrast to these results, I find that financial institutions, such as those that measure the availability of credit information have a less clear impact on payment tenors. My results for financial institutions are often weak or contradictory. I also find no significant results when market power is measured by the total size of a buyers sourcing volume.

This analysis could be extended in several respects. Instead of proxying for a supplier's access to external finance by measuring credit markets, an actual estimate of a supplier's cost of external capital would be preferable. However, given that most of the suppliers in my sample were private companies in emerging markets, it is not possible to get reliable time series data on cost of capital for a reasonable proportion of these firms. Similarly, data on a buyer's creditworthiness over time would enable us to examine how creditworthiness interacts with market power and a supplier's access to credit markets. In this sample, there was no variation in the creditworthiness of the buyers for which public information was available. Another way in which this work could be extended is by incorporating better measures of market power. The number of suppliers a buyer sources from, though a precise metric, would be better when combined with an estimate of local competition that is more comprehensive. Estimates of local supplier concentration would greatly improve this analysis, but it is questionable whether creating accurate time series data of this sort for many, mostly developing, countries is feasible. A very promising avenue of future research would be to look at the economic effects on a supplier's performance based on their decision whether or not to extend their trade credit terms.

Overall, I believe that investigating the factors that affect how firms determine their payment tenors is a very important area of future research, because of its large economic significance and the fact that its importance will continue to increase as more firm activities are outsourced, and increasingly to countries with weak credit markets and weak financial institutions.

Appendix

4.1 Variable Contract Enforcement

The main model in this chapter looks at suppliers in countries where courts either enforce contracts stringently enough that a supplier never reneges on a contract (e.g. $\alpha > v(e^*)$) or do not enforce contracts at all ($\alpha = 0$). When courts partially enforce contracts, this has the effect of reducing the returns to both parties, and allowing the buyer to source from the supplier without having to promise to source from that supplier in all future periods, in a larger number of scenarios. Specifically α affects the threshold value of the likelihood of future crises $\bar{\gamma}$ above which the buyer can not pay the supplier enough (both because the supplier requires too high of a price and because the buyer has an incentive to renege if the price is too high) to ensure that the supplier provides first best effort, without promising to source from the supplier in all future periods. This threshold value $\bar{\gamma}$, including α is:

$$\bar{\gamma} = \left(1 - \frac{(1-\beta)\left(\frac{v(e_L)}{2} - e_L - \alpha\right)}{\left(v(e^*) - e^* - \frac{v(e_L)}{2} + \alpha\right)}\right)$$

Consequently, an increase in α increases $\bar{\gamma}$, reducing the range ($\bar{\gamma} < \gamma < 1$) in which the buyer must commit to always sourcing from the supplier. However, the effect is continuous and the level of enforcement needed to guarantee that the buyer will never need to make a long term promise to always source from the supplier in the weak enforcement country (i.e. $\bar{\gamma}$=1) is:

$$\alpha = \frac{v(e_L)}{2} - e_L$$

That is, the penalty for reneging must be at least as large as the supplier's payoff when he reneges in order to ensure that the buyer will never need to commit to always sourcing from the supplier in the weak enforcement country.

4.2 Alternative Payment Scheme

When $\gamma > \bar{\gamma}$, I have shown that a buyer is better off promising to source from S_W in all periods and to just source from S_S when there is no crisis. This is because *B* can not credibly offer a high enough price to S_W in a single period to prevent him from reneging, without also promising to always source from him. An alternative arrangement is for *B* to propose a payment scheme whereby he pays S_W a price p_γ in periods where there is a crisis – but does not source any product from S_W – and p_0 when there is no crisis – and he does source product from S_W. At the same time *B* would source the good from S_S in all periods.

In order for this price scheme to be high enough that it deters S_W from reneging in a period where demand is high, it must be the case that his return from reneging cannot be higher than his discounted future payoff, i.e.:

$$\frac{v(e_L)}{2} - e_L \leq \sum_{t=0}^{\infty} \beta^t (1-\gamma)(p_0 - e) + \sum_{t=0}^{\infty} \beta^t \gamma p_\gamma$$

Since *B* will want to minimize the expected amount he will pay S_W – and will want S_W to provide the effort e^* that will maximize his surplus – he will choose the lowest p_0 and p_γ such that S_W is indifferent between reneging and complying, i.e.

$$\frac{v(e_L)}{2} - e_L = \sum_{t=0}^{\infty} \beta^t (1-\gamma)(p_0 - e^*) + \sum_{t=0}^{\infty} \beta^t \gamma p_\gamma$$

$$\frac{v(e_L)}{2} - e_L = \frac{(1-\gamma)}{(1-\beta)}(p_0 - e^*) + \frac{\gamma}{(1-\beta)}p_\gamma \quad \{8\}$$

Now let us consider the payoff that *B* expects to get by using this payment scheme. Under this scheme he always sources from S_S getting an expected net payoff of $\sum_{t=0}^{\infty}\beta^t(v(e^*) - e^*)$. When there is no crisis he also sources from S_W getting $\sum_{t=0}^{\infty}\beta^t(v(e^*) - p_0)$, but when there is a crisis he must also pay $S_W \sum_{t=0}^{\infty}\beta^t p_\gamma$. Thus, *B's* expected net payoff for using this alternate scheme is: $\sum_{t=0}^{\infty}\beta^t(v(e^*) - e^*) + (1-\gamma)\sum_{t=0}^{\infty}\beta^t(v(e^*) - p_0) + \gamma\sum_{t=0}^{\infty}\beta^t p_\gamma$

$$\frac{1}{(1-\beta)}(v(e^*) - e^*) + \frac{(1-\gamma)}{(1-\beta)}(v(e^*) - p_0) + \frac{\gamma}{(1-\beta)}p_\gamma \quad \{9\}$$

We can substitute {8} into {9} which gives us:

$$\frac{1}{(1-\beta)}(v(e^*) - e^*) + \frac{(1-\gamma)}{(1-\beta)}(v(e^*) - e^*) - \left(\frac{v(e_L)}{2} - e_L\right)$$

However, this expected net payoff is identical to that of always sourcing from S_W and just sourcing from S_S when there is no crisis. That payoff, from {3}, is:

$$\sum_{t=0}^{\infty}\beta^t\left(v(e^*) - e^* - (1-\beta)\left(\frac{v(e_L)}{2} - e_L\right)\right) + \sum_{t=1}^{\infty}\beta^t(1-\gamma)(v(e^*) - e^*)$$

$$= \frac{1}{(1-\beta)}(v(e^*) - e^*) + \frac{(1-\gamma)}{(1-\beta)}(v(e^*) - e^*) - \left(\frac{v(e_L)}{2} - e_L\right)$$

Consequently, this alternative payment scheme, where S_W is paid during times of crisis, but not required to produce any goods, is no better for the *B*, than choosing to source from S_W in all periods.[62]

[62] There are also a variety of organizational behavior factors (not modeled) that would make it less efficient to use such a payment scheme and in interviews with supply chain professionals involved in the footwear and sportswear industries, no person reported having heard of such a payment scheme.

4.3 When Suppliers in Strong Enforcement Countries have Lower Costs

I now consider the case where the efficient supplier is in *Strong* (S_S^e), and the inefficient supplier is in *Weak* (S_W^i). In the context of my data this is the less plausible case as, in labor intensive industries, costs of production are almost invariably positively correlated with stronger institutions. Here the efficient supplier, S_S^e, never reneges on a contract and therefore *B* can make him a take it or leave it offer such that *B* pays a price just equal to his cost. As before, *B* will demand the level of effort that maximizes his value, e^*, but now he only needs to pay a fraction of the price, i.e. $p = \frac{e^*}{\theta}$, since S_S^e's costs are lower. Sourcing from S_W^i remains unchanged from the base case, and consequently, the threshold $\bar{\gamma}$, remain unchanged.

In this context it never makes sense to source from S_W^i and not S_S^e because if *B* sources from S_W^i and not S_S^e, S_W^i has an incentive to subcontract production to S_S^e who is willing to produce the unit for a price below S_W^i's costs. Consequently, *B* is always at least as well off sourcing from S_S^e as from S_W^i.[63] Therefore, *B* always sources from S_S^e and only sources from S_W^i in periods where there is no crisis. The price that *B* must pay S_W^i and the effort that S_W^i provides depends on the risk of crisis γ. If $\gamma \leq \bar{\gamma}$, then *B* will, as before, be able to use relational contracting without making a long term commitment and pay price $p = \frac{(1-\beta)}{(1-\gamma)}\left(\frac{v(e_L)}{2} - e_L\right) + e^*$ for effort $e = e^*$. If $\gamma > \bar{\gamma}$ then relational

[63] Note: This result only holds because I have not assumed any transportation costs. If it is the case that the cost of transportation between S_W^i and S_S^e exceeds the difference in efficiency between S_W^i and S_S^e then there are parameter values for which it is optimal for *B* to make a long term commitment to S_W^i.

contracting in just non-crisis periods breaks down and *B* can only elicit effort $e = e_L$. In neither case can *B* improve performance by making a long term commitment to S_W^i or S_S^e.

Thus, in this context, where the supplier in *Strong* is more efficient (i.e. has lower costs) than the supplier in *Weak,* long term commitments do not help the buyer source more effectively from either supplier. Consequently, since long term commitments are not used there is no tradeoff in flexibility that arises from the use of relational contracting.

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